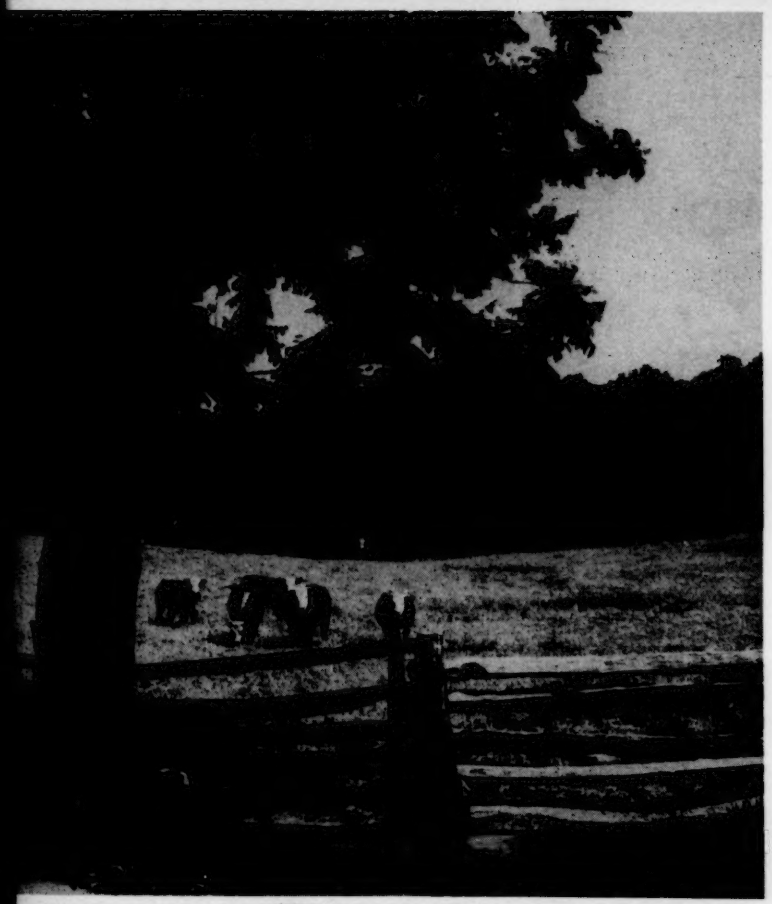

Volume 11, No. 2 **March, 1956**

Land Use in Russia
. . . Herb Plambeck

Some New Developments in Soil and Water Conservation Research

The Origins of the Conservation Philosophy
. . . Clarence J. Glacken

Drainage Practices and Problems
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The Canadian Colombo Plan Resources Survey of West Pakistan
. . . Richard C. Hodges

Book Reviews: Managing the Farm Business; Vegetable Production and Marketing; How to Develop Watersheds; Man and the Winds; and others.

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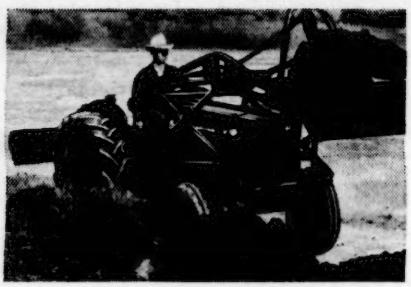

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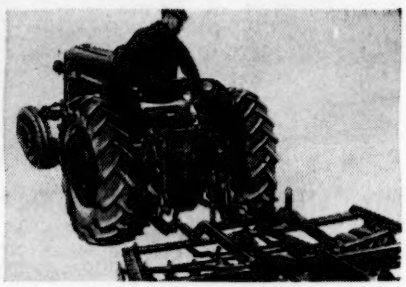

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VOLUME 11
NUMBER 2

Journal of SOIL AND WATER CONSERVATION

TO ADVANCE THE SCIENCE AND ART OF GOOD LAND USE

This JOURNAL is the official organ of the Soil Conservation Society of America. It is owned, edited, and published bi-monthly by the Society.

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***Cover Photo:** Purebred beef breeding herds and improved pastures are found in many parts of the country but abound throughout the Great Plains. Members of the Society attending the annual meeting in Tulsa, Oklahoma, October 15, 16, 17, 1956 may see some of the top breeding stock in the Nation, as well as improved pastures, in that vicinity.*

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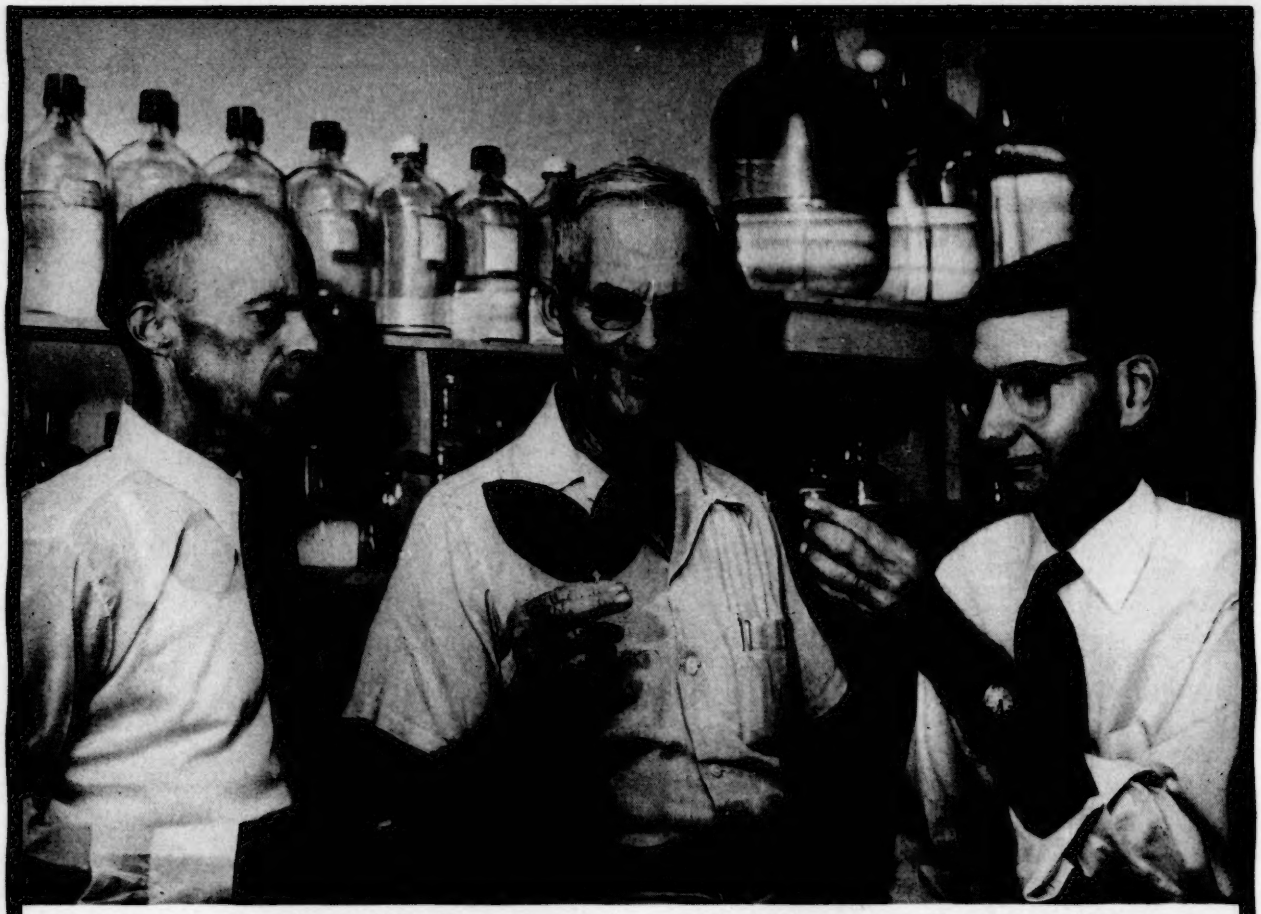

C. D. Leonard, L, and Ivan Stewart, R, Florida Citrus Experiment Station, talking with A. C. Mathias, citrus grower. Doctors Stewart and Leonard established the fact that *yellow spot* on citrus leaves is caused by molybdenum deficiency. They also showed that moly spray effects a rapid recovery of citrus trees affected by this deficiency disease. Many Florida citrus growers are now using molybdenum.

Florida experience shows how Moly controls crop disease

Water soluble Molybdenum can be spray-applied alone or mixed with other sprays.

Yellow spot on citrus leaves is caused by molybdenum deficiency, research discloses, and it can be controlled by spraying affected trees with sodium molybdate. Now Florida citrus growers are using molybdenum for the control of yellow spot.

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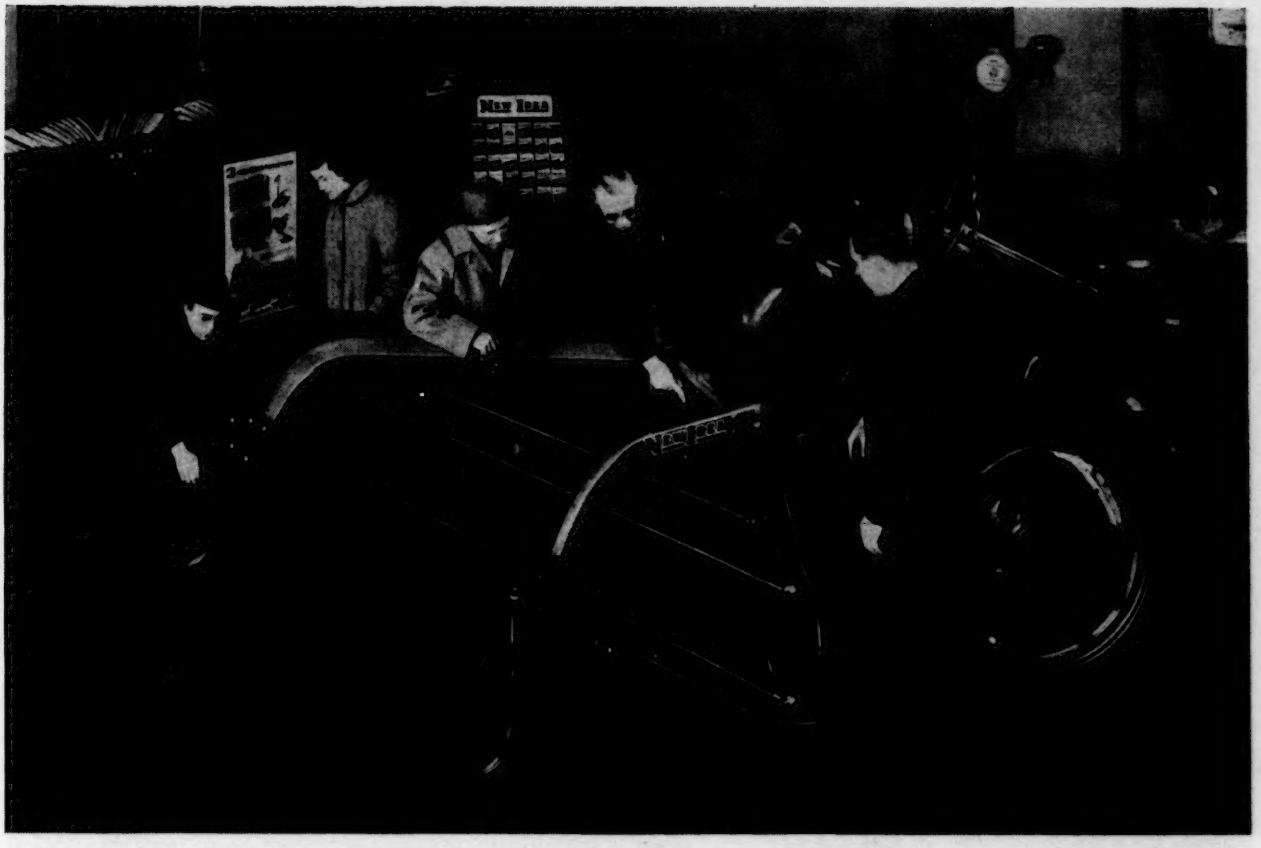

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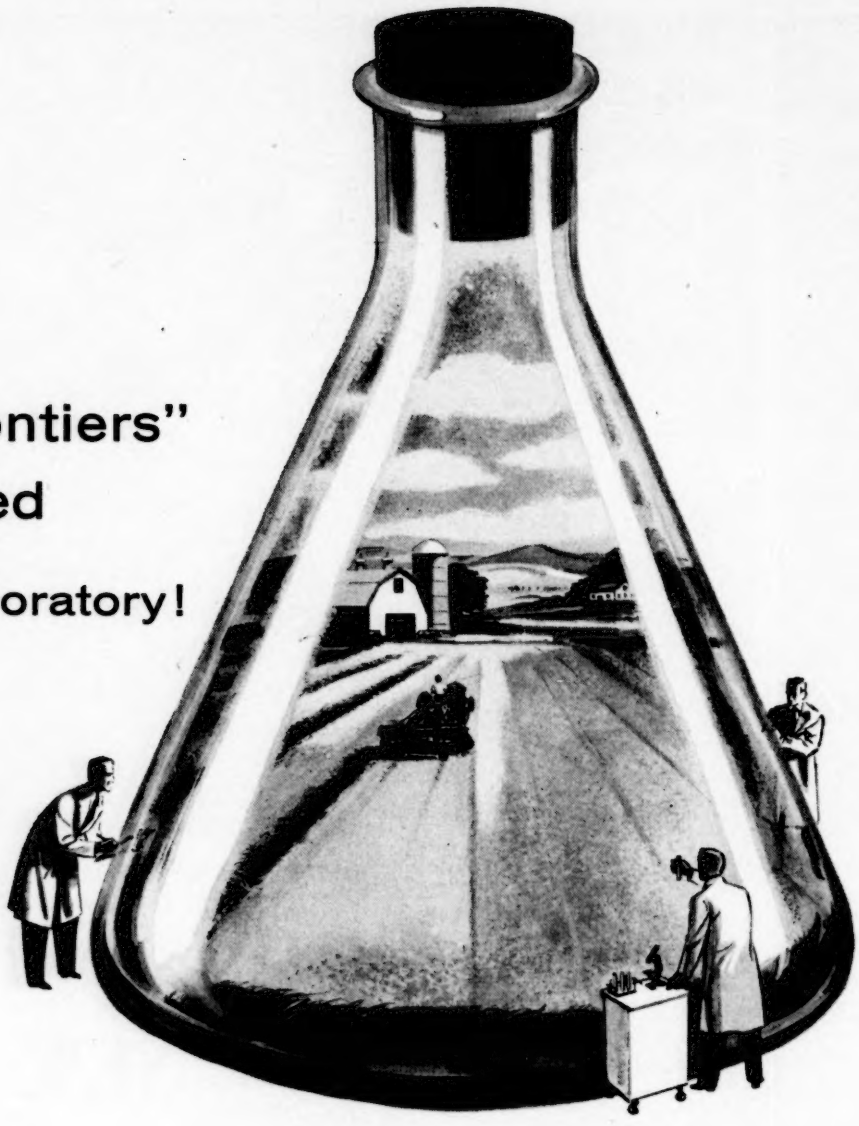

Some specialists say grasses and legumes are now at about the same stage of development as open pollinated corn was 50 years ago. It is generally conceded that *most* of the improved varieties grown today are selected from the "wild."

Take the standard time-tested Sudan grass, introduced shortly after the turn of the century. Recent introductions of Sudan grass, such as *Piper*, *Tift*, and *Lahoma*—all of which are now disease-resistant—show what research can do.

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Land Use in Russia

HERB PLAMBECK

Mr. Plambeck

Here is a first hand description and analysis of some of the agricultural and land use development programs in parts of Russia, Central Asia, and Siberia. The author was a member of the American Farm Exchange group that visited these areas last summer.

Russian scientists, the author points out, recognize the seriousness of the erosion problem; also the need for contour cultivation, terracing and other soil management practices. The American group concluded that even though Russia has a long way to go in developing a land use program, she will probably do considerable catching up in the next decade or two.

MY FIRST GLIMPSE of Soviet Agriculture came while our party, made up largely of practical farmers, was flying from Helsinki, Finland, to Leningrad, Russia. It was little more than a fleeting glance at some of the grazing areas and haylands in the northern section of the USSR. Darkness set in soon after we left Leningrad so our flight to Moscow gave little opportunity for additional farm impressions.

Moscow, as most JOURNAL readers know, is the showplace, as well as the capital, of Russia. We saw a multitude of interesting sights . . . the Kremlin, Red Square, Moscow University, the All-Union Soviet Agricultural Exposition, and many other USSR "show window" projects.

Although we saw relatively little of farming during our first three days in the Soviet Union, we did have the opportunity to meet officials of the United States Embassy, as well as USSR Ministry of Agriculture leaders. Ambassador Bohlen, Agricultural Attache Davis, and others in the Embassy impressed us very favorably. Information about Russian agriculture, however, was limited because of Soviet reluctance to make facts and figures available.

The Russian Ministry of Agriculture officials proved to be more congenial than we anticipated, and were more willing to divulge general information than we had expected. It must be remembered, however, that the *"Spirit of Geneva"* was running high at the time of our visit. Without question, the talks between President Eisenhower and Premier Bulganin then in progress in Switzerland gave us access to much information and to some observations no Americans had previously been able to get.

Changes in the Soviet Farm System

During the first day's meeting we learned something about the background of the Soviet farm system as it now exists. Prior to the 1917 Revolution, there were 18,000,000 peasant farms in the Soviet Union. By 1928 the number of peasant farms had increased to 25.6 million, due in part to the breaking up of large estates and distribution of the land to the peasants who had been working it. A program was inaugurated in 1918 to combine the small plots into collective farm units. However, this development moved rather slowly until the early 1930's when a collectivization drive forced the small farms into collective units. At the present time, there are approximately 89,000 collective farms, 5,000 state farms and 9,000 machine tractor stations.

That Soviet agriculture was an extensive enterprise became quickly evident. In our first briefing by Ministry of Agriculture leaders, we learned there are three types of farm production units in Russia. *They are State Farms, known as Sovkhozys; Collective Farms called Kolkhozys; and Machine Tractor Stations.*

State farms, as the name implies, are owned and operated by the state somewhat like a factory in the Western World. The workers are paid a flat salary which is based on an eight-hour work day. These workers receive their base pay regardless of the outcome of the harvest. Provisions for extra pay are made for overtime and for premiums if the farm exceeds its annual production plan.

Collective farms were established by combining many plots of privately-owned land into cooperative or collective units. The income which collective farm workers receive is determined by the outcome of the harvest. If environmental conditions or other factors cause a poor harvest, the farm workers receive very little remuneration for their year's work. On the other hand, in favorable years when crops are good, the workers receive proportionately more. In either case, the peasant is paid according to the amount of work *(expressed in terms of work day units)* done during the year.

Herb Plambeck, an active member of the SCSA, is farm news editor of Radio Station WHO-TV, Des Moines, Iowa. He was the American Farm Radio-TV representative on the American Farm Exchange group that toured Russia in 1955. Mr. Plambeck is also active in Kiwanis and other civic and agricultural activities.

Figure 1. This photo shows the effect of soil erosion on a Russian hillside. Americans were deeply impressed by the need for more conservation practices. In recommendations made to Soviets, the U. S. delegation placed contouring, terracing, and other conservation practices high on their list of suggestions.

Machine Tractor Stations are owned and operated by the state. For the Soviet Union as a whole, there is an average of one MTS for approximately ten collective farms. MTS workers receive a fixed base pay plus additional pay for overtime work during rush seasons.

Most of the field work on collective farms is done by machines provided by the Tractor Stations. A collective farm pays for the services of the machines with farm produce. Because Machine Tractor Stations are state-owned and operated, the produce they receive from the collective farms is an important state source of agricultural commodities. The collective farm is required to make obligatory deliveries of specified quantities of its produce to the state at extremely low prices. Additional produce is sold to the state at contract prices which are considerably higher than obligatory delivery prices.

Russia's food and feed needs are rapidly expanding. This is based on an increase in both human and livestock numbers. Authoritative final figures are not obtainable in the Soviet Union, but reliable estimates indicate some 3,000,000 babies are born in Russia annually, and that the total population now is approaching 215,000,000. Livestock was greatly depleted during the transition period between Czarist days of private ownership and 1935 when Collectivization reached its peak, and then again drastically reduced during World War II. They are now being stepped up tremendously.

Because of the need for more food and feed, the Soviets have a world of problems on their hands. They must find the answers to two major questions: *How to make more efficient use of manpower and woman power, and how to handle their soil and water resources more successfully.* As a member of the Soil Conservation Society of America, I was greatly interested in the latter of these two questions, and this was equally true of several other members of our delegation, particularly our group leader, Dr. W. V. Lambert, Dean of Agriculture, University of Nebraska, and an SCSA member; Dr. Wm. Reed, of Greensboro, North Carolina, a nationally known soil scientist; Loren Soth, editor of the *Des Moines Register*, originator of the tour, as well as several of the farmers in our delegation.

The Breadbasket of Eastern Europe

Our first real look at Russian farms came early one morning while we were bumping our way on a steam powered train to Kharkov, enroute to the rich Ukraine, the breadbasket of Eastern Europe. Vast fields of nearly ripe wheat were to be seen. Harvesting apparently was just getting started. Collective farm homes were all in villages and of adobe or stucco type, painted white, with neatly thatched roofs. There were no individual farmsteads. Nor were there any automobiles or trucks along the dusty roads, but countless rickety, old wagons, each drawn by one horse, were noted. High arches extended over the horse's withers, thus holding the shafts together. Usually an elderly man or woman was doing the driving.

Literally millions of white geese were being herded by women, near streams, and in newly harvested fields. We saw no fences anywhere. As a consequence, cattle and hogs, as well as geese, were being handled in open fields by women and girls. The cattle were nondescript in appearance. Hogs were mainly of a white breed, resembling our Yorkshires.

As the sun started burning the morning dew off the grass and grain, and as our coal burning locomotive chugged mile after mile through endless fields, we noted some harvesting getting underway. Everything from hand sickles to 24 foot wide self-propelled combines were in use. Most of the field workers were women, wearing plain clothing and babushka shawls, working in brigades of about 25 persons each. Men, however, were handling the tractors. Where old fashioned threshing machines were the vogue, oxen, as well as horses, were used to haul bundles and grain.

Much haying was being done, with hand rakes and wooden forks often the vogue. Haystacks were very numerous and looked neat and trim. Occasionally, large bundles of hay or other items were being transported on peoples' backs. In the villages we saw many hand carts

being pushed, and women were carrying water and milk pails, by means of old wooden yokes, on their shoulders.

We saw some corn, but compared to the wheat and barley, yields did not seem promising. Potato fields, and large tracts of vegetables were also prominent. Weeds were plentiful in all the fields, especially in the corn. Individual garden plots were numerous in the villages, and usually looked well cared for and free of weeds.

John Steddom and I must have stood there in the train hallway two hours watching the Ukrainian farm and village panorama sweep by. We were constantly making comparisons between our modern U. S. methods and Russia's old fashioned system. In general, they seemed 50 years or more behind us, except for some of the massive machines they were using in the large wheat areas.

Conservation Practices Are Needed

It was during this opening "look-see" at Russia's farm landscape that I first noted conservation and other land use needs of the USSR. The second page of several hundred pages of voluminous notes made during the five week trip carries this notation, "Entering hilly area. Seeing considerable erosion now. No contouring, strip cropping, or terracing. They simply avoid the deep gullies."

As we clicked along over the rails that first morning in the Ukraine, we all saw the effects of erosion in the sloping areas of Russia's richest farm area. Another one of my notations reads, *"Much need for conservation here."* The sights along the way prompted me to devote my first report for 400 or more American radio and TV farm directors I was serving to Russia's conservation needs. *Later, after we saw the evidence and effects of erosion and land mis-management in many other sections of the USSR, I was gratified to note that one of the major recommendations our Farm Exchange group made to the Ministry of Agriculture was the urgent need for more attention to conservation practices.*

Our 10,000 mile tour behind the Iron Curtain not only took us through the agricultural and industrial areas of European Russia, but also into the Central Asian sector, strong in its Oriental influence, and finally, into that strange land far east of the Urals—that place of exile and intrigue called Siberia. Most of our long journey was devoted to agricultural observations. As a consequence we had a good opportunity to note land use in Russia.

First a word about the land itself. Russia has a lot of fertile soil, particularly in the Ukraine and Kuban areas which are in the southern part of western Russia. Much of that soil is of the Chernozem type, black and fairly deep . . . much like the soil that we have in western Iowa, eastern Nebraska, and parts of the Dakotas. Chestnut is another of the types found over a considerable area of Russia. There are lighter soils of course, in Central Asia . . . and there is much desert area in that region. In fact, we flew nine hours one day over land that was almost entirely of desert nature. When we arrived in western Siberia, we again came across some black soil and to our amazement, found much of it in effective production.

I would say, with Dr. William Reed of the Agricultural and Technical College at Greensboro, North Carolina, who was the soil expert in our group, that the pressure on land in not particularly acute in Russia, even though the pressure on doing a better job of production is very definitely a factor.

We were also impressed by the vastness of Russia's land area. All told the USSR has more than 8,570,000 square miles of land, not including its satelites. The United States, on the other hand, has 3,022,000 square

Figure 2. *Left:* Standing in a field of lucerne *(alfalfa)* three members of the American Farm Exchange group visit with an attractive Russian "swineherd." Members of the party are Herb Plambeck; Lauren Soth, editor, Des Moines Register, who initiated the American-Russian Farm Exchange and State Senator Asa Clarke, Pullman, Washington wheat farmer. The young lady seen in the picture is responsible for ten sows which she feeds and cares for, along with their offspring, including the handling of the animals on the unfenced range. The picture was taken on the Venci Zarnya State-Hog farm near Rostov. The alfalfa *(called lucerne in Europe and Russia)* was considered an excellent pasture by both the Americans and the Soviets. Note the wide expanse of fertile, rich soil. *Right:* Dual purpose cattle on West Siberian collective farm. These are of the Kazak breed. Poor pasture conditions prevailed throughout this area due to the drouth.

Figure 3. Picture of a herd of camels and calves in the Asian area visited by the American farm delegation. Camels are used for transport, wool production, meat, and milk production.

miles. Since Russia's land area is nearly three times that of ours, and her population only fractionally larger than that of the United States, pressure on land is not as acute. However, there are other problems facing USSR farmers and Ministry of Agriculture leaders.

Rainfall is one of the limiting factors and so, of course, is climate. We were in several sections where rainfall averaged from 12 to 18 inches. For the most part, Russia lies considerably north of our latitude here. In fact, the better farming areas we visited would correspond pretty largely with the climate in North Dakota and the northern half of Minnesota. When we got up into Siberia, we were in an area roughly corresponding to about the center of Hudson Bay in Canada, and with some of the upper Manitoba and Saskatchewan wheat areas. That means a short growing season for a lot of the crops that we depend on here, such as corn. In fact, in Western Siberia, we saw them trying to raise corn where the growing season is not more than 75 days. We were there during the middle of August and the area had already had a killing frost.

Soil Management Problems

In addition to some of the obstacles Mother Nature has thrown up, Russian farmers have some other problems to face too.

The question of Soviet land policy or land management obviously comes to your mind. I discussed this with Dr. Reed, whom we considered an able soil scientist, and with whom I spent considerable time while in Russia. He feels that the Russian land policy leaves quite a lot to be desired. In fact, he feels that the Soviets have regressed some on soil management. They are cropping the land too hard. They are careless in the management of the soils, as seen by the deep gullies in many of the rolling areas. Moreover, they are not using grasses and legumes anywhere near as well as they might. Lucerne, which is alfalfa to us, is their main legume and certainly does well, but is not used very extensively. I distinctly remember the Venzi-Zarnya hog farm, not far from Rostov, in the fertile Kuban region, located east of the Crimean peninsula and just north of the Caucasus Mountains. That farm has many good hogs and they are being raised on some very fine alfalfa. But that place is the exception to the rule.

JOURNAL readers will be interested in the rotation followed on some of the better Kolkhozys we visited. It is a 10-year rotation involving at least one year of fallow. This is the way it was given to us through our interpreters. The first year, fallow . . . then seeded to winter wheat in the fall. The second year, wheat, followed by sugar beets the third year, then spring wheat the next year, followed by two years of grass, plowed up in the summer of the second year, and put to wheat two years in succession (or in some cases a year of fallow). Then the ninth year, corn or sunflowers, or sugar beets . . . and then the tenth year, spring wheat . . . followed in turn again by fallow.

In some sections, a 10-year rotation would have as many as three years of fallowing. But the ever-increasing pressure for more food and feed for a rapidly growing human and livestock population, is resulting in the cutting down on the number of years of fallow.

Chances are corn will become increasingly important in the rotation. In the early spring of 1955 Kruschev ordered Russian farmers to increase their corn acreage 400 per cent. Early this year, a delegation of Soviet farm experts finished up a buying trip in the United States in which they purchased a huge quantity of hybrid seed corn for planting in Russia this spring. Corn is grown mainly for silage purposes, and is expected to help materially in Soviet milk production.

New Lands Project in Western Siberia

Most amazing of all Soviet efforts to increase their production of food and feed supplies is the New Lands project in Western Siberia and North Kazahstan. Kremlin leaders have ordered the plowing up of 75,000,000 acres of bleak, barren and desolate new lands in that section, and have had them planted to spring wheat, corn, and other short season crops. Magnitude of the undertaking is quickly understood when it is pointed out the project encompasses an area as large as the states of Kansas and Iowa combined.

Billions of rubles have been poured into this undertaking. Tens of thousands of workers have been recruited from urban as well as rural areas of the USSR. Great quantities of machinery have been provided. We were told that in one section alone 25,000 large five-ton diesel powered, crawler-type tractors, along with plows, seeders, planters, combines and other necessary equipment were placed. Roads have been bladed out of the windswept steppes. Villages have mushroomed in the area as new log or sod homes are being built.

How successful the project will be remains to be seen. In its first year, 1954, abundant rains enabled the Soviet New Lands pioneers to reap a good harvest. Last year when our farm group became the first Americans to set foot on that section, our shoes sank into four inches of dust. Drouth reduced some yields drastically. Spring wheat was doing about seven bushels per acre, corn about three. Yet the people did not seem to be overly discouraged. They looked upon this as their opportunity to do something special for what they call "the glorious cause of Communism." If the drouth continues, they may have started the world's worst dust bowl. Possibly, if rains come, they will step up food and feed supplies considerably.

Along with wheat, corn and potatoes, Russian collective farmers also grow vast acreages of sunflowers, flax, cotton, hemp, sugar beets, grapes, orchards and other crops for food, feed or fiber. Many thousands of hectares of castor beans also are grown.

Grasses and legumes, however, seem to get little emphasis. Most grazing areas appeared very poor. About all we saw was a coarse grass, and much of it looked rather dormant during the hot summer season. Sheep had been moved well up the mountain slopes to find green forage. Pasture renovation might well be undertaken on a much greater scale in Russia.

As for tillage many things are different in Russia than in the United States. Most of the plowing is done in the fall, with the use of five and six bottom plows pulled by five-ton crawler-type diesel tractors. Every third or fourth year deep plowing, down to ten inches or more, is practiced. Furrows often are a couple miles long. Stubble mulching, however, is also being practiced.

When it comes to cultivating row crops, the Soviets go in for that in a big way. Corn is cultivated six or seven times regularly. Some of the cultivators were drawn by horses. In addition to the machines, large brigades of women workers were regularly seen at work with hoes.

Regarding use of fertilizers, Russia is rapidly expanding in that direction. Best estimates we could get were about eight million tons used annually. Super phosphate was the type most often mentioned but ammonium nitrate and potash also were strongly in the Russian plant food picture. Sizeable fertilizer spreaders were seen, and attachments on corn, cotton, and other planters were common.

Agricultural College at Kharkov

Of particular interest to Dr. Lambert, Dr. Reed, and myself was the soil testing laboratory at the Kharkov agricultural college. A widely recognized scientist—called an Academician over there—Alexeg Sokolovsky was in charge. A very capable man, with great respect for Dr. Hugh Bennett's work in this country, Sokolovsky took great pains to tell and show us about their work. Stress is placed mainly on increasing yields, fighting drouth, controlling erosion, and battling winter kill. Many soil maps were to be seen in the laboratory, but most of them

Figure 4. *Top:* West Siberian farm worker with Ralph Olson, Iowa farmer and soil conservation district co-operator, left, and Feris Owen, Ohio potato grower, right, in corn field in Russia's "Virgin Lands" area where the USSR is sponsoring a seventy million acre project to get additional food and feed production. Corn suffered severe drouth and early frost and was estimated by American visitors to do not more than five bushels per acre. *Bottom:* Wheat and other grains coming from threshing and combines are stored on the ground preparatory to cleaning operations. This picture was taken in Siberia and shows in background the permanent storage building made of poles and straw. Siberian "new lands" farmers have had to improve many of their farm buildings including the storage structures.

Figure 5. *Left:* Five-ton crawler-type diesel-powered tractors are used extensively for plowing and other field work in Russia. In every case where plowing was done, the Americans found one man on the tractor, and the other on the plow. *Right:* Collective farm worker with a Soviet corn combine, one of the most modern farm machines seen by the U. S. group in Russia.

were of pre-World War II vintage. Hundreds of soil profiles were also on display, but they too were old. Equipment in the lab was far below the standards in our American institutions. Nevertheless, the institute was turning out about 600 agricultural graduates each year, and has supplied specialists for virtually every section of Russia.

Alexeg Sokolovsky recognized the seriousness of the erosion problem and told how it prevailed in the Dnieper River Valley and the Volga Basin and in many other parts of Russia where we later saw the evidence for ourselves. He recognized the need for better soil management, particularly contouring and terracing. He also was well aware of the value of fertilizers on sugar beets, corn, and other crops. The Russian scientist told of the use of Moscow radio and of Russian papers to disseminate information about better land use in the Soviet Union.

Our visit with Sokolovsky and other scientists in various parts of Russia, Central Asia, and Siberia reaffirmed the observation that Russia has a long way to go in stressing better land use. However, with the USSR training many more scientists, engineers and other technicians than we are, our American farm group came to the conclusion that Russia probably will do considerable catching up in the next decade or two.

Exchanges of information, such as that undertaken by the two groups involved in the Soviet-United States farm exchange project of 1955, might well make for increased production on the part of the Russians. Americans probably have little to gain in the way of technical know-how from the Soviets, but the hope of the American Exchange group who made the fascinating journey last year is that *all the world has something to gain from a better international understanding, and from better land use Behind the Iron Curtain and everywhere else.*

Conservation Is a Way of Thinking

Conservation is not something that can be controlled exclusively by legislation. It is largely a way of thinking and a way of living. It is as fundamental as honesty and thrift, and it must be achieved in much the same way. The only way true conservation can be achieved is through universal education toward that goal. The ingrained habits of civilized man must be changed. We have the knowledge and the educational facilities with which to change these habits, but it will be almost as difficult as changing some of the instinctive habits of wild animals. The education must be started early in the life of every individual and continued for as long as he or she is an active participant in our economic and social life.

—TOM DALE AND VERNON G. CARTER, *From Topsoil and Civilization*

The Origins of the Conservation Philosophy

CLARENCE J. GLACKEN

One of the most powerful and deep-seated ideas in Western thought is that the earth and the arrangements of living nature observable on it are the products of divine effort and design. This idea, points out the author, was widely but by no means universally held by the classical thinkers, the whole argument with statements for and against being lucidly summarized in the second book of Cicero's* On the Nature of the Gods. *It is also a basic idea of the Old and the New Testaments, both of which, moreover, reveal a strong feeling for the beauties of nature, the Psalms perhaps being the outstanding example.

HISTORICALLY, the view of the earth as a planet designed and made habitable for all forms of life has involved two attitudes toward living nature: It is beautiful and it is useful. In Christian thought there has been nothing accidental in the combining of these attributes, for the earth was beautiful because it was an expression of the perfection of the Creator, and it was useful to man because he could get from it physical sustenance and the religious inspiration to worship his Creator. This conception of the earth was a dominant one through the Middle Ages and early modern times and was still important in the nineteenth century, as shown by the number of natural theologies written by scientific men, such as the geologists, John MacCulloch and Hugh Miller (1), although it had come under increasing criticism beginning in the eighteenth century because of the teleology which was assumed in the argument from design. As a consequence of this belief, the Western idea of man as part of nature has never been quite forgotten despite opposing tendencies such as the divorcement of humanistic and scientific inquiry and specialization within disciplines.

There was one significant assumption in this religious conception of nature: In the natural order of things, men would use their environment, changing it for their own ends and improving on its natural state; in descriptions of nature which appear in works with this theme, both pristine and domesticated nature are described, the descriptions often intermingling: The forests of the mountains are set off from the tilled fields of the lowlands; the olive or the fruit trees form neat rows on the borders of wild-growing low-lying shrubs; the peasant huts are built along the stream; the domestic animals tended by their herders graze in the forest.

In the writings from the seventeenth to the nineteenth century which were devoted to the design argument, whether in natural theology, philosophy, natural history, geography, biology, or other disciplines, nature was conceived of as a usufruct and man as the highest being in the creation had responsibilities as well as privileges in using it. His role with regard to the rest of creation was often looked upon as that of a steward or a caretaker of God. In the works of such physcio-theologists as John Ray and William Derham, man has the role of a partner of God in improving primeval nature, in conversions of natural landscapes for his own purposes, in agriculture, in the clearing of forests, in the drainage of swamps: His improvements in soil fertility through the use of manuring and marling were other instances of the partnership of man and his Creator not only in maintaining but in improving the earth, through his inventiveness, for his enjoyment and use and for the greater glory of God (2).

In addition to these ideas, there were others of a more humble and practical origin which in their cumulative effects had a great influence on the development of conservation, ideas based on observations that human activities brought about undesirable changes in nature. These observations accumulated not in philosophies and in natural theologies but in learned and technical works; one sees them in increasing number in the eighteenth century. It is these two trends, one, aesthetic, philosophical and religious, the other, practical and technical, that have characterized ideas of conservation throughout its history.

Forests Were Recognized in Late Middle Ages

These notices, mostly descriptive of local conditions, began to accumulate in the late Middle Ages. For the most part they concerned the use of the forests. Concern about them was not a new phenomenon; one has glimpses of it in classical and post-classical times, in the legislation of Roman, Byzantine, Merovingian, and Carolingian times. *The forests of Europe were related intimately both to the economics and the amenities of life, and there were conflicts of interest in using them. The most obvious—and the one that has been emphasized in modern times—was the indirect conservation of the forests because they were royal or noble hunting reserves.* They were also the source of wood fuel to keep kilns and smelters going, and of wood for building purposes. Forests were often centers of the beekeeping industry which was important before sugar was known, and there was a lively trade in beeswax for making candles used by monasteries in the

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forest wilderness. *Forests were grazing lands and the early attitudes toward them, and the legislation enacted regarding them, cannot be understood without realizing that their importance as grazing lands for sheep, cattle, goats, and especially for swine often was equal to or greater than their significance as wood producers. It was the complex role of the forest in the economy which brought about laws and regulations governing the uses of forests in every European country* (3).

The practice of transhumance often meant clearance of forest lands to increase mountain pastures at the expense of trees. There were conflicts too between farmer and herder in the width and use of sheep runs through agricultural land. It was, however, the extensions of agriculture and industry at the expense of the forests that were most conspicuous: Agriculture meant cutting and burning of trees; the *assarts*, the *Brandwirtschaft* that continued in some parts of northwestern Europe, in Finland for example, until the latter part of the nineteenth century. Furthermore, wood and water were the great sources of energy before the age of coal. *Another explanation for the growth of the conservation idea thus is to be sought in conflicts of interest with regard to use. There are two famous illustrations of these conflicts, John Evelyn's Silva which was first published in 1664, and the celebrated forest ordinance of Colbert of 1669.*

In his *Silva*, a landmark in the history of silviculture, Evelyn describes the encroachments of agriculture, the dangers of grazing and of metallurgy; the competition in land use can plainly be seen. Agriculture, Evelyn said, was extending itself at the expense of the forests, and the iron mills were destroying them because of their demands for charcoal to reduce the ore and in the working of iron. Evelyn's remarks reveal the existence of problems posed by the innovator and the conserver: The distribution of minerals which a culture finds useful, even indispensable, conflicts with the preservation of the forest whose existence is governed by entirely different physical circumstances. *Early modern conservation ideas are really a recognition of the fact that the distribution of mineral deposits with relation to forests, even with the industrial development existing before the Industrial Revolution, meant the slow, relentless destruction of nature* (4).

Resource Decrees Date To Thirteenth Century

One of the merits in studying the history of legislation is that laws are excellent indications of the abuses which provoked their enactment; they are less trustworthy guides regarding accomplishments because of the gap between intent and enforcement. Colbert's famous declaration that France would perish for lack of wood was not a sudden outcry against forest destruction; it was a condemnation of practices which had been commonplace in France for centuries, for the ordinance, approved by Louis XIV, was the latest and most complete of a series of decrees dating back to the thirteenth century. One general provision of this long law sums up rather well the problems it was trying to solve: *"We forbid them [the Grand Masters of the Forests] to permit or suffer any kilns, furnaces, charcoal-making, grubbing and up-rooting, lifting or removal of beacons, acorns, and other produce from our forests, contrary to the provisions of these presents, on pain of arbitrary fine, and reparation of all our damage and interests* (5)."

From the late eighteenth to the mid-nineteenth century, the literature relating to conservation increased both in scope and in depth; there has been no break in the continuity since those times. French, Italian, German, Austrian foresters, engineers, and hydrologists studied the problem of deforestation as the cause of Alpine torrents, among whom the names of Fabre and Surell are perhaps the best known. In this period the long discussions concerning deforestation and climatic change were pursued with vigor, including among the scientists such famous names as von Humboldt, Boussingault, and Becquerel (6). New works on land reclamation and the making of polders—the Dutch with their long experience had already created an extensive literature—were part of an effort to extend these techniques throughout Europe to reclaim land. Studies on the fixation of sand dunes, important because the encroaching sands inundated villages, were made from the dune areas of the Atlantic and North Sea shores to those of Pomerania and East Prussia. Fixation through the planting of maritime pines had already been undertaken in the Landes region of France in 1795. Scientists began investigating soil erosion of the Mediterranean basin and of Asia Minor; Carl Fraas, for example, made an extensive study of the deterioration of the lands of Asia Minor and the eastern Mediterranean, ascribing it to the loss of vegetative cover (7).

First Reference Work on History of Conservation

Despite its volume and scope, there was no real synthesis of this literature until George P. Marsh published in 1864 *Man and Nature;* or *Physical Geography as Modified by Human Action.* Marsh had an impressive command of his subject, the result of travel, observation, and exhaustive reading of the contemporary literature; he documented his work in modern fashion, and, in addition to its other merits, it is a valuable reference work on the history of conservation. Marsh's main examples were the countries of northwest Europe and the Mediterranean. In making a study of lands which had a long history of human settlement, Marsh warned his countrymen—by comparing environments of old with those of newly settled regions—of the dangers of disturbing the balance of nature. The lands of the New World would require careful husbanding if they were to remain habitable for future generations. He wrote his work to show the immense

power exerted by man throughout history in modifying the natural environment, discussing his role in plant and animal domestication and in the activities of domesticated animals like sheep, goats, and camels, really extensions of human activity; the consequences of deforestation, Marsh's chief concern, for it was the preoccupation of many scientists of that period; man's effects upon the waters and upon the sands.

The importance of Marsh's work from a conservation point of view is that it clearly demonstrated that conservation was an historical, cultural, and philosophical problem: throughout history the earth had been changed by peoples who neglected or ignored the effects of their destruction of the natural environment. It is noteworthy that virtually all of his examples refer to the period prior to the Industrial Revolution.

In the work of Marsh, the idea of an organized and harmonious nature designed by the Creator for the use of all organic life and with man at the apex of the scale is merged with this vast technical literature: From it came a philosophy of nature and of man's responsibility in maintaining it as a usufruct. Man should be faithful to his stewardship, for the earth was beautiful and useful because the Creator had intended it to be so.

Long before Marsh's time, however, American agricultural writers, naturalists, and farmers had already observed and written about deforestation, soil exhaustion, and soil erosion. Some of this literature was inspired by English writings, but much of it came from the observation of local conditions. Among the most well-known of these early conservationists were Jared Eliot, Thomas Jefferson, John Taylor, and Edmund Ruffin (8).

Another American, Nathaniel S. Shaler, was an outstanding figure in the last quarter of the nineteenth century because, like Marsh, he looked at conservation from a world point of view and because he was interested in so many phases of the subject. Shaler, a geologist, expressed a conservationist philosophy similar to that of Marsh, but he emphasized more than Marsh had the importance of understanding soils and the seriousness of soil erosion. In an article which appeared in the *National Geographic Magazine,* Shaler, who was no pessimist, warned his countrymen in vigorous language of the danger that their soils would wash away if they neglected to care for them. His monograph on soils was prepared to assist anyone desiring an understanding of soils, an essential study he thought for settlers in a new country whose traditions concerning the soil of a district were comparatively meager. Shaler was a man of very broad interests; in his later writings, he presented one of the earliest and most interesting analyses of mineral consumption by modern civilization, and he advanced ideas concerning the resources of the seas, future energy sources, and the changes which man, with his growing numbers, would continue to make on inorganic matter and organic life on earth. Shaler represents a shift from the old emphasis on deforestation, characteristic of Marsh and his predecessors, to a new one, concerned with the contemporary and future uses of the forests, soils, and minerals (9).

Exploitation of Land Resources

The expanding economies of the latter part of the nineteenth century produced a correspondingly expanding literature on the need for conservation. A German economic geographer, Ernst Friedrich, popularized the word *Raubwirtschaft* (plunder economy), attempting at the same time to find a rationale in man's exploitation of the world and finding it in the formula that unwise destructive exploitation led to poverty and distress which in turn would lead to rational exploitation (10). The British parliament investigated the causes of deforestation in India. Studies of the tropical plantation, of shifting agriculture and grazing in the tropics were beginning to appear. There was a growing literature of protest against the wholesale killing of the plume birds, the bison, the big game of Africa, seals, and whales; one writer referred to the times as an "age of extermination."

In the United States, the rapid extension of settlement had brought about an awareness, among men interested in conservation, of the changes which were transforming the country. *It was different from old Europe where the contrast between virgin land and settled land was deep in the past. In America the contrast was real to a single generation:* In the sixties Marsh was warning of possibilities which were realities in the nineties. There is a vigor, a comprehensiveness, a sense of urgency in this late nineteenth and early twentieth century American literature; the tone is unmistakable in the early report of Frederick Hough, in the Report of the National Conservation Commission which followed the White House Conference of 1908, in the proceedings of the first Conservation Congress in Seattle, and in the pages of Van Hise's famous textbook (11). There is an emphasis on the need of maintaining the balance of nature, on developing resources without waste, on the intimate association between a nation and its resources (perhaps nowhere more eloquently expressed than in this literature) and the need of safeguarding and of restoring the natural beauties of the country. Although these investigations had their origin, as Gifford Pinchot has said (12), in the movement for forest conservation which is so closely associated with his name, it should be remembered that forestry was a broad term. These men were interested in the forests, in the streams, in the grazing lands, and in the soils; *the idea of conservation had expanded to include the material resources and values.* There was a great deal of optimism in America during this period, but a few men also took advantage of the unparalleled oppor-

tunity to soberly study the immense power which modern societies had acquired to change their physical environments.

Summary of Contemporary Conservation Ideas

Although it would be rash to attempt in this brief space a summary of contemporary conservation ideas, a few general observations may be helpful in understanding the literature of today and how it differs from that of the nineteenth and the early part of the twentieth century.

In the first place, much more is known about the nature and distribution of the world's soils. Speaking generally, from classical antiquity to the time of Liebig in the middle of the nineteenth century, the main preoccupation of students of soils was with the maintenance of the fertility of arable lands; soil science, closely identified with agricultural chemistry, was practical in its goals and in its research. In the late nineteenth century, the work of Hilgard in America and of Dokuchaiev and his school in Russia called attention to the need of studying soils in their own right and independently of the practical considerations of agriculture. From these investigations of little-worked or virgin soils of the United States and Russia our modern concepts of the nature of soils have been derived, and soil science today is much more closely related to conservation than it was in the last century.

In the second place, the ecological point of view is much more in evidence today than it was in the past. The idea of a close and interlocking relationship in nature is an old one; its origin can be traced to the idea that nature was a divinely arranged harmony. The concept of the unity of nature, however, was given more specific meaning by von Humboldt's studies of plant geography, by Darwin's concept of the web of life, and by many of the late nineteenth century ecologists. Modern studies of the populations of biotic communities, of the history of vegetational change, and of the effects of cultural changes in biotic communities have done much to broaden the theoretical bases of conservation, even though there has been criticism of some ecological theory such as the succession and the climax concepts.

In the third place, the American dust storms of the thirties have had a great influence on conservation ideas because they occurred in combination with the depression and the widespread migration from the Dust Bowl. Their effect was to revive an old but neglected point of view that conservation was deeply involved in history and in the cultural values of a society. The surveys of Bennett and of Jacks and Whyte which followed called attention to the world-wide nature of these problems (13).

Since the end of World War II, a new combination of old ideas has resulted in a greater emphasis on the power of human cultures in changing the environment, on the relation of custom and law to conservation, and on the increased growth of the world's population. There have also been renewed attempts to create a conservation ethic and philosophy, a moral and aesthetic attitude toward nature which, I cannot help but feel, is the modern substitute for the earlier scientific and religious belief that the world of nature with all its beauty was a harmonious whole designed by the Creator.

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Drainage Practices and Problems

P. J. ZWERMAN, A. J. BAUR, R. B. MUSGRAVE AND A. M. GOODMAN

Approximately two million acres or 22 per cent of all crop land in New York State is so poorly drained naturally that it represents a serious farm problem. This paper shows the extent of poorly drained land for the state's five major soil areas. Artificial drainage practices are evaluated for each of the major soil areas in terms of: (1) kinds of drains used, (2) amount of drains installed under past and current practices, (3) crop adaptation to natural soil-drainage classes, and (4) problems that are found in present practices.

EXPERIENCED FARM management specialists say that poorly drained soils in the Northeastern United States are difficult to farm profitably (9). Many people (1, 2, 4, 5, 8, 10, 12, 15, 17) have studied various aspects of the drainage problem in relation to land use, the soil itself, and specific crop production, including forest trees. In developing a science of soil and water conservation including the drainage of land, it would be highly desirable to have a better understanding of drainage practice. Through this study it would be possible to isolate the most urgent problems. The solution of these problems would lead to improved farm drainage.

Soil areas or great soil groups are the logical basis for classifying the drainage problem

According to the latest Agricultural Census the approximate land area of New York State is 30,684,160 acres. Cropland is approximately 8,484,763 acres. By using Cline's (6) generalized soils map five soil areas were outlined (see Figure 1). The boundaries for these areas were established by using all existing soil survey data. Poorly drained land was also compiled by soil areas from these soil surveys. Poorly drained land includes the soil-drainage classes of very poor, poor, and somewhat poor as defined in the Soil Survey Manual (14). Ten representative sample areas were selected in the five soil areas in order to study the relation of poorly drained land to land use. Each of these samples had been mapped in detail in the regular course of standard soil survey work in New York. Soil type with slope and erosion phases as well as land use or cover were mapped on a scale of four inches equals one mile. The area of each sample under detailed study ranged from 3-13 per cent of each soil area from which it was selected (see Figure 3). Areas within the Adirondack Mountains were excluded.

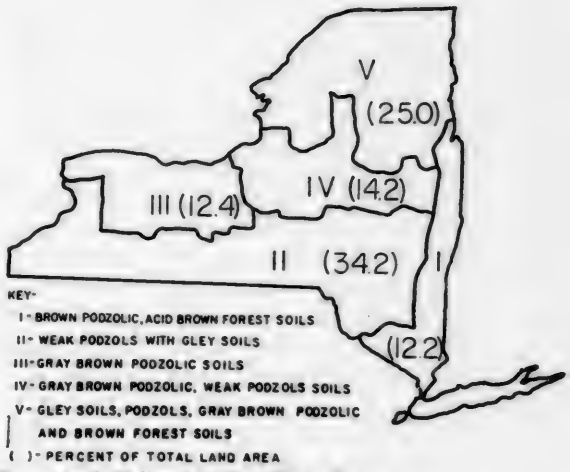
V
(25.0)
III (12.4)
IV (14.2)
II (34.2)
I
(12.2)
KEY-
I - BROWN PODZOLIC, ACID BROWN FOREST SOILS
II - WEAK PODZOLS WITH GLEY SOILS
III - GRAY BROWN PODZOLIC SOILS
IV - GRAY BROWN PODZOLIC, WEAK PODZOLS SOILS
V - GLEY SOILS, PODZOLS, GRAY BROWN PODZOLIC AND BROWN FOREST SOILS
( ) - PERCENT OF TOTAL LAND AREA

Figure 1. Soil Areas in New York State.

Figure 1 names and locates the soil areas. Figure 2 shows the distribution of poorly drained land for each soil area and land use. Sample areas are shown in Figure 3 by crosshatch. Figure 4 contains the summarized results from the older soil surveys, the census, and the small sample study. Apparently, the older more generalized surveys did not indicate as much poorly drained land as the more recently surveyed detailed samples. Figure 4 also indicates the general intensity of land use by soil areas as well as the distribution of poorly drained land.

How poorly drained land is used in the various soil areas of New York

There is a general impression that almost all of the land that could be farmed was, at one time, cleared and farmed. Then the least desirable land was permitted to become idle and revert to poor pasture and forest. The data in Figures 2 and 4 would tend to show that this is true for all poorly drained land in each soil area except for Areas I and II. Here, apparently, the forests contain steeper land and fewer poorly drained soils.

But where the soils are calcareous (Area III) a high proportion of poorly drained land is cultivated (see Figure 4). In this connection the observations of Adams (1)

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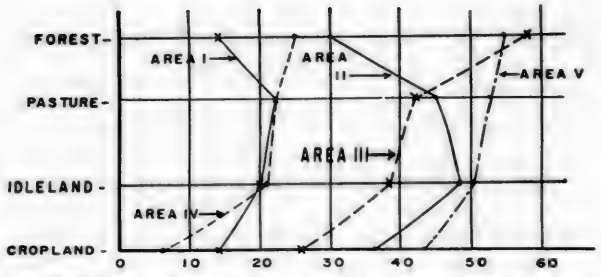

Figure 2. Per cent of poorly drained land in each land use.

should be noted. He states that imperfectly or somewhat poorly drained soils on calcareous materials have a higher proportion of cropland than similar drainage classes for soils developed on non-calcareous materials. There are no detailed data available bearing on the reasons for this situation. The following are possible explanations: 1. The presence of sufficient lime in the subsoil or throughout the profile improves the soil for plant growth to the point that the drainage limitation is more easily overcome by field crops. 2. The high lime areas of New York State generally contain more old drains (see Table 1). These old drains are concentrated for the most part in the low areas. Therefore, they may make it possible to farm these naturally more poorly drained locations. 3. The better drained soil classes in Area III are practically all used for cropland. But the topography of the area results in small, poorly drained areas which are intimately associated with the better drained soils. On the other hand, in Area II the poorly drained soils frequently are found in larger areas, and, therefore, are not readily cultivated together with the better drained associated soils. 4. In general, Area II is at approximately 1,000 feet higher elevation than Area III; as a result, its growing season is 20 to 60 days shorter.

Area V contains a higher per cent of poorly drained land in its cropland than does any other soil area. Much of this cropland is to be found in the poorly drained soil-drainage class rather than the somewhat poorly drained soil-drainage class as is the case in other soil areas of the state.

Many Kinds of Artificial Drains Are Used

Artificial drainage is as old as New York State agriculture. The open ditch has always been widely used. With the development of more public roads, an increasing number of open ditches have been associated with road construction. Soil conservation district work has resulted in more open ditching on farms. Numerous farm waterways have also been constructed. Many fields have been surface drained by using diversion terraces.

Underdrains were first constructed of stone. Many are still in use. Gradually these stone drains were replaced by tile drains. Tile drains are now generally used except in those locations where the open ditch can function satisfactorily as both a surface drain and an underdrain. The various kinds of artificial drains currently used in New York State have all been adequately described (18).

Reasons For Extent of Drain Installation in Different Soil Areas

An estimate of the extent of artificial drain installation under past and current practice was obtained in the following manner: *a. All public roads were assumed to have an open ditch on at least one side of the road; b. Farm outlets, diversion terraces, open drains, and closed underdrains were compiled from the annual reports of the Soil Conservation Districts and also from the annual reports of Extension Agricultural Engineers. Current practice was considered to be all installations since 1940; c. Old drains were considered to be those reported on the 1930 drainage census of Agriculture for New York State; d. An annual rate of investment in drainage was calculated for each soil area and for the state as a whole.* This annual rate represents the average rate for the soil over the period of time during which soil conservation districts operated in that soil area.

The kinds of artificial drainage practices used are listed in Table 1. It's apparent that the extent of public road ditches are in proportion to the geographical size of the soil areas in question. Recent farm outlet construction appears to be more nearly in proportion to diversion ter-

Table 1: Current Artificial Drainage Practices in New York State.

Types of Artificial Drains	Soil Areas I	II	III	IV	V	State
Outlets: Public road ditches thousands of miles	8.82	31.66	11.98	11.68	11.91	76.05
Farm ditches & waterways, total installed ft./Acre cpld.[1],	0.262	1.316	0.264	0.256	0.041	0.414
Annual rate of installation ..	0.039	0.144	0.026	0.032	0.012	0.040
Surface: Diversion terraces, total installed	0.117	3.190	1.135	0.916	0.054	1.100
ft./Acre cpld., Anual rate of installation ..	0.018	0.336	0.113	0.112	0.015	0.120
Underdrains: Open, total installed	0.778	1.052	2.581	2.000	0.215	1.015
ft./Acre cpld., Annual rate of installation ..	0.117	0.112	0.258	0.240	0.057	0.117
Closed total installed	0.208	0.855	4.340	0.870	0.012	1.110
ft./Acre cpld., Annual rate of installation ..	0.030	0.096	0.434	0.104	0.006	0.120
Old drains, per cent cropland	3.1	5.42	32.80	11.20	2.85	11.00

[1]Cropland.

race construction than to any other single factor. One would conclude that many recent underdrains are being outletted into natural water courses, road ditches, or old, previously constructed outlets.

The diversion terrace has been constructed almost entirely under the technical supervision of the Soil Conservation Service technicians operating through locally organized soil conservation districts. A properly constructed and maintained diversion terrace together with its filter strip represents a fifty-foot strip of permanent hay or sod (18). This wide strip of hay or sod fits in very well with extensive forage crop production in Soil Areas I, II, and V (19).

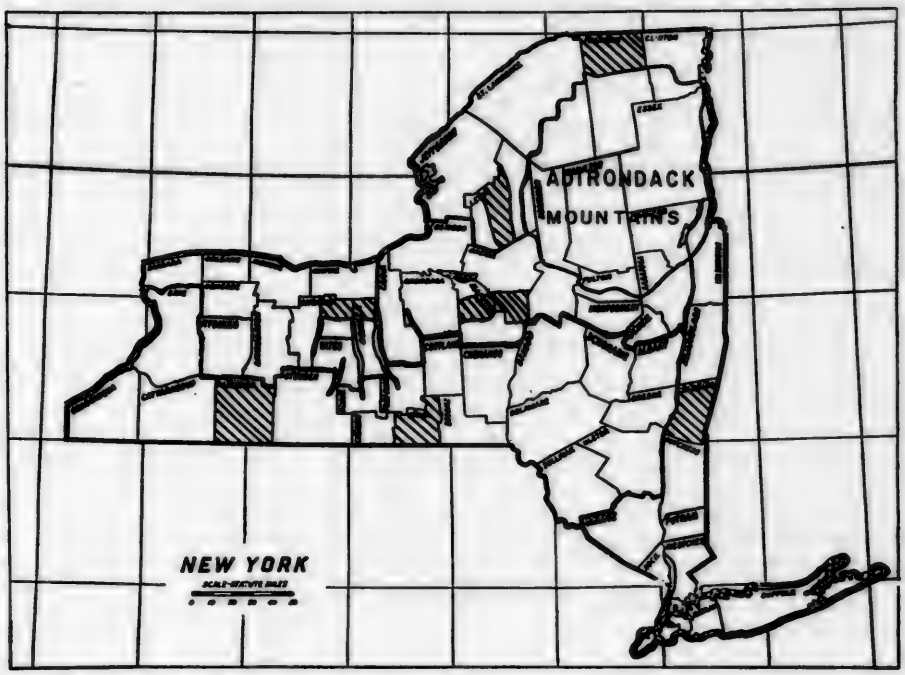

Figure 3. Sample area locations.

Relatively few soil conservation districts have been in operation in Soil Areas I and V during the period of this study. This fact together with the low per cent of poorly drained soil in Soil Area I may account for the relatively small numbers of diversion terraces. In addition Soil Areas I and V have unfavorable topography for diversion terrace construction. Area II, in contrast has more favorable topography for this type of structure, and soil conservation districts have been in operation for a long period in most of this part of the state.

The low proportion of diversion terraces in Soil Areas III and IV is not because of a lack of technical assistance. There may be less favorable topography than in Soil Area II. However, the reason may well be found in the fact that such terraces would take from ten to twenty-five per cent of the cropland out of cultivation.

The distribution of underdrains in the different soil areas can be explained in a similar manner. In Soil Areas II and IV the relatively high proportion of open ditches are usually recommended for and installed in pastures where they also function as surface drains. The high proportion of cropped land in Soil Area III very likely accounts for the fact that this soil area has a high proportion of closed underdrains as compared to open ditches (see Table 1).

A Crop Yield Experiment Concerned with Soil Fertility and Soil-Drainage

Yield data for field crop adaptation, by soil-drainage classes, are not available for all soil areas of the state. However, in Area II a long time fertility level experiment, being carried out on the Mt. Pleasant Agronomy Department Experimental Farm has made available data for a limited study of such crop adaptation. This experiment located on the Bath-Mardin-Volusia soil catena without artificial drainage contains 168 plots. Yield data reported here are taken after one complete round of the rotation and more or less represent the situation after the soil has responded to the fertility treatment. The crop rotation used is corn-oats-red clover-timothy-wheat-red clover. Varieties are those usually recommended for the soil area.

There are seven separate fertility levels in the experiment. The treatments in terms of lime, fertilizer, and farm manure are combined into low and high fertility for analysis. For the high treatment the lime level is that recommended by Cornell for maintaining lime. The high rates of fertilizer may be considered also as recommended or economical. The low rate may be regarded as a minimum rate of lime fertilizer, and manure used by some farmers.

The low fertility on an annual average application rate per acre consisted of: manure, 3.5 tons; finely ground limestone, 277 pounds; P_2O_5, 13 pounds; K_2O, 50 pounds; and nitrogen, 7.5 pounds. The high fertility average annual rates were: manure, 5.3 tons; finely ground limestone, 677 pounds; P_2O_5, 30 pounds; K_2O, 50 pounds; and nitrogen, 7.5 pounds. Annual manure fertilizer and lime costs for the low fertility treatment were

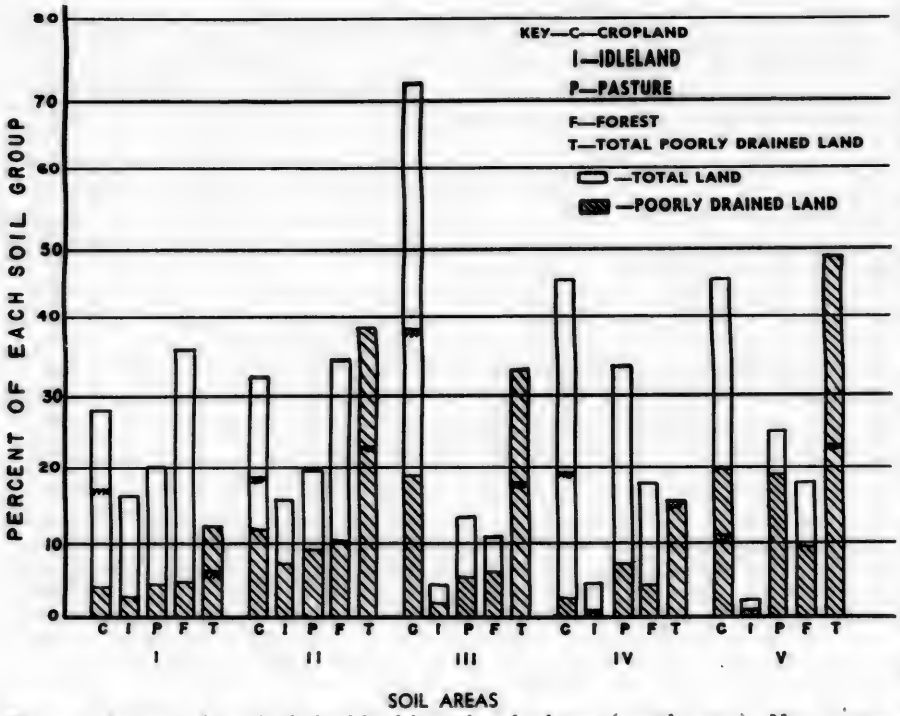

Figure 4. Amount of poorly drained land in various land uses (*sample areas*). Note reverse crosshatch for cropland by census and total from older soil survey.

$9.57 per acre per year, while average comparable costs on the high fertility were $15.21.

The prices used in calculating the costs and return on this rotation are given below: corn silage, $8/ton; oats, $60/ton; hay, $20/ton; wheat, $75/ton; manure, $1.50/ton; finely ground limestone, $8/ton; 20% super phosphate, $35/ton; muriate of potash, $55/ton; ammonium nitrate, $88/ton.

Also, for purposes of this analysis the individual plots were considered to be either moderately well drained—Mardin channery silt loam—or somewhat poorly drained —Volusia channery silt loam (13). Plot yield data were rejected at random until equal numbers of yield were available for each crop every year in each soil drainage class, and fertility level. This procedure permitted an analysis of yields by crops, soil-drainage-class, and fertility level (see Table 2).

The rotation used for the fertility level experiment does provide some information on adaptation of grasses and legumes to soil-drainage classes. However, it does not provide this information over a wide range of soil types for various grasses and legumes. Unfortunately this detailed information is lacking.

Good Natural or Artificial Drainage Necessary for High Soil Fertility Response

Although not shown in Table 2, there is no interaction between drainage class and soil fertility level. That is to say, both drainage classes show the same per cent of crop yield increase when their fertility is increased.

Wojta (20) reported similar findings with an artificial treatment of surface drainage. It should be observed, however, that in neither case was there any considerable application of nitrogen fertilizer utilized. The yield response of corn and wheat to both soil drainage class and soil fertility treatment is pronounced (see Table 2). The marked contrast in the behavior of red clover in its response to soil fertility level rather than soil drainage class can, perhaps, be accounted for by the fact that it is responsive to phosphorus and lime. In addition to being tolerant of fairly wet soil conditions, the red clover supplies its own nitrogen. The contrasting behavior of timothy response to soil drainage class rather than soil fertility level might be accounted for again in the very low application of nitrogen. The somewhat poorly drained soil class very likely has less available nitrates during the early spring and summer than would the moderately well drained soil class.

Wojta reported (20) a marked increase in oat yield associated with surface drainage treatment. However, these higher yielding oats were also planted at an earlier date because of the drier soil condition on the surface drained area. The oat plantings reported here were all made at the same date. Jensen,[1] at Cornell, has made a date of planting study indicating that oat yields are responsive to date of planting. Plantings after the last

[1]Personal communications.

Table 2: Mean Yields (1947-52 inclusive) Fertility Level Experiment Mt. Pleasant

Crop Rotation	Soil-drainage class: moderately well drained	Soil-drainage class: somewhat poorly drained	Yield Diff.	Return Diff.	Fertility: high Recommended	Fertility: low Minimum	Yield Diff.	Return Diff.
	Bu. or tons			Dollars	Bu. or Tons			Dollars
Corn Silage	13.7	10.8	2.9[1]	23.20	13.7	10.8	2.9[1]	23.20
Oats	34.1	30.8	3.3	2.97	34.0	31.5	2.5	2.25
Red Clover	2.2	2.0	0.2	2.00	2.4	1.8	0.6[1]	6.00
Timothy	2.0	1.7	0.3[1]	3.00	1.9	1.8	0.1	1.00
Wheat	32.7	19.8	12.9[1]	25.80	31.4	21.4	10.0[1]	20.00
Red Clover	2.7	2.5	0.2	2.00	3.0	2.7	0.7[1]	7.00
			Mean	9.83			Mean	9.92

[1]Significant at 0.01 level.

week in April decreased in yield at the approximate rate of one per cent per day. Latter planting would almost surely result from the inability to till somewhat poorly drained soil classes early in the spring.

Crop Yield Response to Natural Soil-Drainage Class, a Useful Method for Estimating Yield Return on Artificial Drainage

In considering the yield differences due to soil-drainage and soil fertility, the soil type differences should be kept in mind. These soil morphological differences, especially structure, have been exhaustively studied by Carlisle (5). The somewhat poorly drained soil might produce more or less than the moderately well drained soil if artificial drainage were installed. However, in the absence of complete experimental data to answer this point, it seems reasonable to use the yield difference reported as a valid estimate of soil drainage class differences. Despite the known soil structural differences, it is further assumed that these natural soil-drainage differences in crop yields are of the same order as differences that would be obtained if the somewhat poorly drained soil were artifically drained to the drainage level of the moderately well drained soil.

The Pennsylvania Agricultural Experiment Station has reported (3) a tile drainage experiment on Volusia soil series in Bradford County. Their reported yield increases for tile drainage by crops are: corn, 30 per cent; wheat, 66 per cent; and hay, 12 per cent. The corresponding yield differences in Table 1 for the natural soil drainage differences are: corn, 27 per cent wheat, 65 per cent; and hay, 12 per cent.

It is interesting to note from Table 2 that the dollar return per acre for drainage is approximately equal to that for the normally recommended rate of fertilization and maintenance rate of liming (high fertility) as compared to the lower rate of fertilization and liming (low fertility). It should be remembered, however, that the difference in cost between these two fertility levels is only $5.64 per acre per year. The crop return for each dollar invested in fertilizer and lime is $1.76. In order to compete with fertilizer and lime economically, artificial drainage, for this crop rotation, would have to be easily and conveniently purchased by the farmer for an annual cost of between five and six dollars per acre per year.

At present costs, tile drainage of the land on the Pennsylvania experiment cited above would be $300 per acre. If one uses the dollar drainage return from Table 2, this investment would return only 3.2 per cent interest. In terms of the crop rotation widely used in the area the interest return on investment is only 1.9 per cent.

The fact that New York State farmers recognize the generally unprofitable character of many artificial drainage practices can be arrived at by another line of reasoning. They spend approximately four dollars per acre per year on all cropland for fertilizer. They spend approximately one dollar per acre per year for lime on cropland requiring lime, but they spend only *twenty-five cents* per acre per year on cropland requiring artificial drainage. This expenditure for drainage is barely sufficient to replace the normal mortality of existing drainage systems.

Table 3: Approximate Cost of Recent Farm Drainage installations New York State as of January 1954

Types of Drains	Assumed Cost Per Unit in Dollars	Total Assumed Original Cost In Thousands of Dollars
Outlets—Public road ditches (miles)	500.00	38,025.0
Farm ditches (feet)	0.15	506.7
Surface—Diversion terraces (feet)	0.10	879.8
Under drains—Open (feet)	0.20	1,629.0
Tile (feet)	0.25	2,221.8
Old drains	?	?
		43,262.3

It is interesting to compare possible drainage returns from the two soil areas, II and III. Present rotation practices in Soil Area II usually are corn-oats-red clover-timothy-timothy. Using the return differences data of Table 2, this rotation would return $5.70 per acre per year for drainage on cropland. The approximate rotation for Soil Area III is corn (50 per cent) or truck crops (50 per cent)—wheat (50 per cent) or oats (50 per cent)—red clover (60 per cent) or alfalfa (40 per cent). Again using return difference data of Table 2 and considering all the row crops to be corn and all the hay to be red clover, one arrives at a benefit for drainage of $13.36 per acre per year for cropland. Or the economic return is approximately 2.3 times as great as in Soil Area II. This economic return is very likely too low because of probable higher response of truck crops and alfalfa.

In this general pattern of drainage in relation to cropping intensity the problem of maintaining soil structure cannot be overlooked.

It is interesting to compare annual rates of investment in drainage by farmers in these two soil areas. This can be done by using Tables 1 and 3. The calculations indicate that in Areas II and III respectively, the annual expenditures for all cropland are 10 cents per acre and 18 cents per acre. But if one considers the fact that in these areas the per cent of cropland that is poorly drained is 36.8 per cent and 26.0 per cent, respectively, and then calculates the expenditures on the basis of poorly drained cropland alone, we find that the respective costs in the two areas are 27 cents per acre and 69 cents per acre. This is a ratio of 2.5. It compares very favorably with the 2.3 ratio calculated from crop returns. We have indicated that this crop return ratio is too low.

Analysis of Practice Shows Farm Drainage Problems That Need To Be Solved

The approximate total investment in artificial drainage is given in Table 3. From this table and Table 1 it is apparent that 89 per cent of the 43 million dollars' total investment in artificial drainage is found in public road ditches. Annual farmer investment in new artificial drainage installations is at the approximate rate of one-half million dollars.

An informal questionnaire circulated among soil conservationists revealed an estimated average effective life of an open ditch to be from eight to ten years. Improved methods of maintaining both public and private open ditch installations should be studied (16). This is true not only from the point of protecting the original investment in the open ditches, but also to protect the investment in underdrains or surface drains that may flow into the open ditch.

Field observations have revealed that diversion terraces and tile drains are not always successful. Marull (11) found that only 73 per cent of the tile drains recently installed in 49 fields functioned satisfactorily. Existing recommendations (7) for farm drainage installations should be tested in the field with a view to more successful design.

Crop response to both natural soil-drainage class and artificial drainage needs to be evaluated. Improved, low-cost, artificial drains would, undoubtedly, greatly increase farm income.

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At the bottom of the Pyramid of Life we find the Soil. Soil together with the air, the water, and the sun makes life possible. There can be no life, such as we know it, without these things!

Life takes two forms, vegetable and animal. The vegetation of the earth (The Green Carpet, as we often call it)is the link between the soil and all animal life. Without the soil there can be no Green Carpet. Without both there can be no animal life!

Man is at the top of the pyramid; the highest member of the animal kingdom, wherein we also find the beasts of the field, the birds of the air, the fishes of the sea, and all other forms of animal life. Man is at the top of the pyramid, the keeper as well as the Master of the pyramid. How well he does the keeping will determine how long he remains the Master of that pyramid.

—M. O. STEEN, *Wildlife and the Soil*

Nature has endowed the earth with glorious wonders and vast resources that man may use for his own ends. Regardless of our tastes, or our way of living, there are none that present more variations to tax our imagination than the soil, and certainly none so important to our ancestors, to ourselves, and to our children.

—CHARLES E. KELLOGG, *The Soils that Support Us.*

The Canadian Colombo Plan Resources Survey of West Pakistan

RICHARD C. HODGES

Canada has been a member country of "The Colombo Plan for Co-operative Economic Development in South and South-East Asia" since its inception in 1950 and is one of the donor countries. The others are Australia, New Zealand, United Kingdom, United States of America, and Japan. The recipient nations are Burma, Cambodia, Ceylon, India, Indonesia, Laos, Nepal, Pakistan, Philippines, Malaya and British Borneo, Thailand and Viet-Nam.

The fundamental purpose of the Plan is "to survey the needs, to assess resources available and required, to focus world attention on the development problems of the area, and to provide a framework within which an international co-operative effort could be promoted to assist the countries of the area to raise their living standards." (1)

THE COLOMBO PLAN was originally seen as a scheme to aid the newly formed countries of India, Pakistan and Ceylon to become strong members of the British Commonwealth, but the changing political and economic scene has expanded its importance as well as its membership. The first six year period (from July 1, 1951 to June 30, 1957) was recently extended, at the 1955 Consultative Committee meetings at Singapore, for another three years.

Accompanying the Capital Aid program is a Technical Co-operation Scheme which "provides a framework for the exchange of technical assistance between participating countries." (2) For example, 292 fellows and scholars have thus far received training in Canada in academic or practical courses in agriculture, engineering, medicine, business and public administration, co-operatives, marketing, and a wide variety of other fields. Canadian experts have in turn carried out assignments in Burma, Cambodia, Ceylon, India, Indonesia, Malaya, North Borneo and Pakistan.

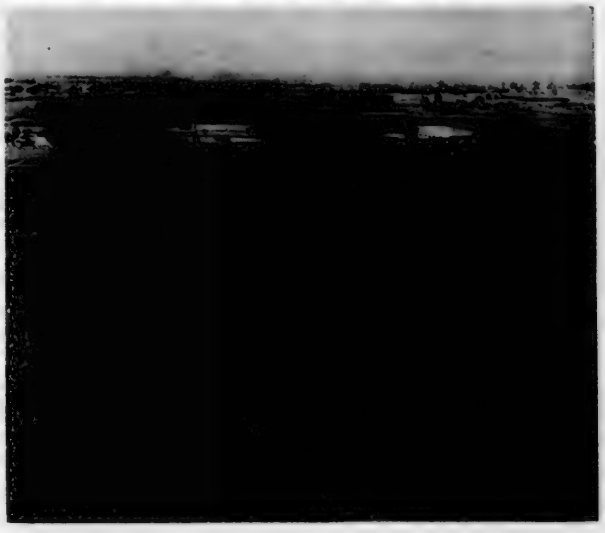
"The Canadian Parliament voted $26,400,000 for use under the Colombo Plan in 1955-56, making a total of $128,400,000 which has been made available by Canada for capital and technical assistance in the first five years of the Plan." Canada's contributions are expected to be increased in the future and will probably exceed $30,-000,000 per annum in the next few years.

The range of projects undertaken under Colombo Plan auspices is remarkable. The following are but a few examples of the kinds of projects in which Canada has participated:

India	
Mayurakshi Power and Irrigation Project	$20,000,000
Railways, 120 steam locomotives	21,400,000
Bombay State Road Transport Corporation, trucks, buses and automotive equipment	4,380,000
Ceylon	
Fisheries Development Project equipment	$ 1,487,000
Electrical equipment, transmission lines	774,500
School of Practical Technology, Construction and equipment	700.000
Agricultural equipment and maintenance workshops	435.000
Pakistan	
Warsak Hydro-Electric Project	
(a) Equipment and engineering services	$13,900,000
(b) Assistance in local costs	10,000,000
(c) Construction Contract and equipment	5,500,000
Thal Cement Plant	6,750,000
Railway ties	2,800,000
Aerial Resources Survey	3,050,000

These services and many more are indicative of the aid that flows into South and South East Asia from all the

Figure 1. Intensively irrigated land in the North-West Frontier Province. Mostly corn and sugar-cane with some sorghum, rice and fallow on medium-textured alluvial soils.



Richard C. Hodges, an active member of the SCSA, is chief of the Soils and Land Use Section of the Resources Division of Photographic Survey Corporation Limited of Toronto. A graduate in Biology from University of Western Ontario and Geography from University of Toronto, Mr. Hodges was the first chairman of the Ontario Chapter of the Soil Conservation Society of America and was professionally employed in soil conservation in Ontario before joining P.S.C.

Figure 2. A Baluchi cultivator prepares his land for sorghum. An alluvial basin in Baluchistan with silt loam and silty clay loam soils.

donor countries, the total impact of which, valued in billions of dollars, is now making itself felt in the economy of the region although the full benefits of these long range programs will become increasingly apparent as time goes on.

The Aerial Resources Survey

Of the various projects mentioned above the aerial survey of West Pakistan[1] is a unique contribution. A credit to the principal of private enterprise, one of the main tenets of our Western way of life, it has been done on behalf of the people of Canada by a Toronto company, The Photographic Survey Corporation, an affiliate of the world-wide Hunting Group of companies.

Canada is especially qualified to provide services in this field, being for its size the world's leading nation in aeronautics and the most advanced country in the application of all phases of air survey techniques. The program in West Pakistan can best be pictured if considered under the three main aspects of the job, photography, geological survey, and soils and land use survey.

1. Photography:

West Pakistan has an area of about 350,000 square miles (similar in size to the Province of Ontario, or the states of Texas and Minnesota combined). Complete air-photo coverage of all but the highest reaches of the Himalayas in the north required the use of two aircraft (a Flying Fortress and a Lockheed Hudson) from our air establishment, Kenting Aviation Limited, between November 1952 and June 1954. Flying at 20,000 feet above ground level and using a six inch focal length camera, they produced photography at a scale of 1:40,000. Some 60,000 9 x 9 prints were required to give stereoscopic coverage of the country.

The film was processed and inspected in the laboratories at the company headquarters in Quetta, Baluchistan, and then sent to the plant in Toronto. Here several sets of contact prints were made and from them about 1500 mosaic sheets also at 1:40,000 scale were prepared for the use of the Resources Survey staff. Two sets of prints were sent to the Surveyor-General of Pakistan. The recent completion of a modern photographic laboratory in Pakistan will enable them to produce reprints and special material from the original negatives.

2. The Geological Survey:

The reconnaissance geological survey of Baluchistan, a little-known and sparsley populated region, covers an area of 125,000 square miles. This is a rather inhospitable land consisting of an arid, mountainous upland lying at an elevation of from 2000 to 8000 feet above sea level. It is inhabited by nomadic and semi-nomadic tribes speaking several different languages. The task of mapping this difficult terrain would, by conventional methods, have taken up to 20 years to complete. However, the techniques of photo-interpretation with adequate field transverses enabled the team of ten geologists to do the work in two years. In addition to the time and thus money saved, the degree of accuracy attained was much greater than that normally obtained by the old methods of geologic survey.

3. The Soil and Land Use Survey:

The mapping of the agricultural resources of the Indus Plains and some adjacent alluvial basins, even at a reconnaissance scale, was a big job. The study of some 80,000 square miles recording landforms, soils and present land use was accomplished by a party of five Canadian and two Pakistani soil scientists during eight months of field work. Here again the maximum use of the air-photographs enabled the party to accomplish in a short time what would have required many years to complete by conventional methods.

Perhaps the best way to explain the approach adopted and the scope of the results would be to give a brief sketch of West Pakistan and its problems followed by an account of the method evolved.

Pakistan, the Moslem country resulting from the partition of India on the termination of British rule nine years ago, consists of two provinces separated by 1000 miles of Indian territory, connected only by an expensive air trip or a long sea voyage. The province of West Pakistan appears to have a stronger base, with a better balance between population and food production although East Pakistan contributes substantially to the national treasury as the world's leading producer of jute. The inhabited area of West Pakistan is about double that of East Pakistan, but it has only 35,000,000 people compared to 40,000,000 in the latter. Most of the people of the Western

[1] A similar enterprise is being undertaken in Ceylon this year by The Photographic Survey Corporation of Toronto on behalf of the Government of Canada.

province live on the Indus Plains which are surrounded on the west by the arid mountain lands of Baluchistan, Waziristan and Afghanistan, on the north and north-east by the Himalayas, on the east by India and the Great Indian or Thar Desert and on the south by the Arabian Sea. The climate throughout is arid to semi-arid except in the foothills at the north although even here the annual precipitation is only 15 to 20 inches. The vast bulk of crop growth depends on irrigation for which the land is, fortunately, well suited.

4. Development of the Survey Plan:

After a preliminary inspection by a Canadian Government expert accompanied by a member of the Resources Survey staff of the Company, a general scheme of operation was drafted in November, 1953. No details of method or legends to be used were specified at this time, rather, a plan of operation was chosen so that a team of two Canadians and two Pakistani could go into the field and assess conditions and design the survey.

The inadequacy of the existing information had one advantage. We entered the field unbiased and in a position to base our judgment on our own observations. The investigations began in the deltaic flood plain of the Indus not far from the capital city, Karachi. Two weeks were spent here and at subsequent locations throughout the country, each selected as being typical of the major geographic regions. These initial studies were completed in three months and the party including the two Pakistani members returned to Toronto to appraise the findings and plan the program for the completion of the survey.

While in the field the party used the aerial photographs and mosaics extensively to ascertain what the various photo-tones and patterns indicated and how much ground observation would be necessary to validate the air-photo mapping of the physical land conditions and the kind and intensity of agriculture as revealed by the present land use. These studies were eased by the use of a Hiller 360 helicopter which provided a bird's-eye view of the terrain and a means of reaching and sampling areas inaccessible to our four-wheel drive Jeep Station-Wagons.

This technique of intensive photo-interpretation combined with adequate ground and air traverses, the whole being carried on in the field where problems are met and resolved on the spot, seems to provide the maximum efficiency for the reconnaissance mapping of soils and landforms. It couples a high degree of accuracy with the main purpose of the reconnaissance approach, namely a speedy overall appraisal of a country's resources. Legends and methods were formulated and a schedule adopted by which a crew of seven men could cover the whole country in eight months of intensive field work. The importance of careful preliminary study and keeping an open mind on legends and classifications throughout cannot be too strongly stressed in undertaking tasks of this kind as exemplified by the fact that this project was finally carried out exactly on schedule yet with a saving of several man-weeks of field work over that originally planned. The final decision on map legends was not made until all the work was finished and a review of the whole was possible in its proper perspective.

Figure 3. Wheat harvest in a canal colony in Punjab Province. The grain is cut by hand with a sickle and threshed by the trampling of oxen.

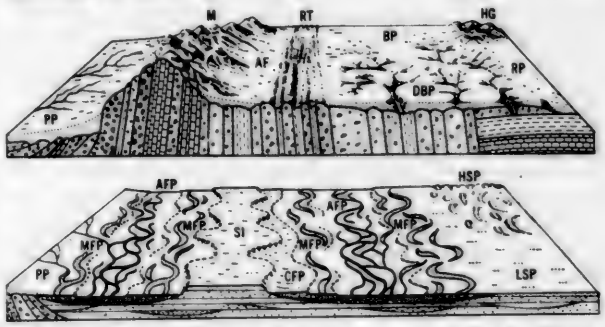


Figure 4. These diagrams illustrate most of the landforms in the text.

How Helicopters Were Used

To better explain the field technique evolved it may be interesting to follow one of the surveyors through the preparation and execution of a helicopter traverse.

The helicopter alternated between the two working parties each of which remained in one locality from six to ten days. The aircraft moved every three to five days joining the party after the latter had had time to do some ground work and air-photo study in the area.

A traverse was planned on the 1½ inch to a mile mosaics to cover 90 to 100 linear miles for the purpose of sampling specific locations not previously reached and to look over areas in which there was a mapping problem. The selection of actual landing spots, usually 12 to 15 per trip, was done after detailed study of the aerial photo-

Figure 5. The helicopter raises a cloud of dust on landing near a field of young wheat. Dust was a constant nuisance in the operation of all vehicles in this dry climate.

graphs so that each point was representative of a typical photo tone and pattern which indicated a landform or soil entity not previously identified or confirmed.

A sufficient number of photographs were chosen to cover the entire route of the flight so that a constant positional check could be made and the planned landing places and the track to be followed were clearly marked on the prints. The normal equipment carried consisted of a four foot screw auger with extensions, a three foot Wisconsin tube sampler (ideal for the moist, light alluvial soils) and a pick and shovel. The one or two dozen prints were clipped to a small "desk" especially fitted in the cockpit for that purpose.

Surface conditions were observed en route and it was possible with the air-photos to locate and indicate to the pilot the exact field in which a landing was desired. On touching down the surveyor would make either a single profile examination with an auger in the vicinity of the aircraft or if more intensive information was required the engine was shut down and he could make several observations in the area and collect a sample for analysis. In all cases the notes were made on the back of the actual print and on returning to base a pin-hole was made through the print, providing a permanent first-hand record of the observation and its exact location. This method was used throughout the survey for all data whether on soils, or land use or any other pertinent information. These observations were supplemented by written notes made on returning from the day's traverse while the information was fresh in the mind.

The helicopter would move from one site to another gradually making a circuit back to base, each trip taking up a morning or afternoon.

Road traverses were planned and made in the same way, the spacing of the sampling points being governed entirely by the complexity or simplicity of the soil pattern as shown on the air photographs. Even though flat alluvial plains such as the Indus might lend themselves to the adoption of a grid method of soil sampling, air photo selective sampling for the separation of landforms, soil types and land use patterns is far superior to any other, especially for reconnaissance surveys. It requires an aptitude not difficult to grasp, and experience in the art of determining the intensity and location of field sampling in order to supply the necessary basic knowledge for the air-photo mapping. Once the elements of the terrain and their appearance on the photographs are identified the work can progress quickly and accurately by photo interpretation.

5. Landforms and Soils:

It became apparent that landforms were the most important feature of the landscape and that these should form the basis of classification of the physical land conditions. Because of the reconnaissance nature of the survey it was necessary to use relatively large units of land to form mutually exclusive categories for mapping purposes. The Landforms were the most definitive features both on the air photographs and in the field. The importance of the landforms became apparent in two ways. The soils throughout the country are closely related to the landform in which they occur. In fact the range of soil types within any one landform is small and is characteristic of that landform wherever found. Secondly, it has been revealed that the use of land is actually related, not to the soils in themselves but to the landform with which these soils are regularly associated.

The map legend includes twenty distinct landforms, several of which have not yet appeared in the literature of Geomorphology. These are as follows:

SI—Scalloped Interfluve
CFP—Cover Flood Plain
MFP—Meander Flood Plain
AFP—Active Flood Plain
DFP—Deltaic Flood Plain
CR—Channel-Levee Remnant
BP—Basin Plain
DBP—Dissected Basin Plain
LSP—Level Sand Plain
RSP—Rolling Sand Plain
PP—Piedmont Plain
RP—Weathered Bedrock Plain
HG—Hilly Gravel Upland
RT—Ridge-and-Trough Upland
DF—Desert Fringe
HSP—Hilly Sand Plain
AF—Alluvial Fan
TD—Tidal Delta
M or R—Mountain or Exposed Bedrock
E—Severely Eroded Land

It, was discovered that the soils could not be classified and grouped into mapping units on the basis of the development of a soil profile because there has been no such development. Although this was to be expected on the alluvial materials recently laid down by the rivers, it was not anticipated on the older pleistocene materials. We believe that the climate here is minimal as a soil forming

Figure 6. *Left:* Leveling new land for irrigation in the province of Sind. Loamy alluvial soils of the lower Indus Plain. *Right:* A citrus orchard on perennial irrigated land in Punjab. Fields of clover, sugar-cane and harvested wheat in foreground. Note effects of salinity on crop growth in the immediate foreground.

factor and must have been so for a very long time. This is most apparent in soils not yet irrigated. The addition of water by irrigation is bringing about movement and some concentraton of dissolved salts. Where salinity has built up to a level which affects crop growth it has been mapped, along with the associated condition of water-logging, as a phase on the Landforms and Soils map. As these processes are recent they are not yet reflected in soil morphology and thus no separations were attempted on a genetic basis. Laterization occurs only in the zone in the Himalaya mountains where there is a significant amount of rainfall.

The differences in the soils from one part of the alluvial plains to another are not great, the most noticeable feature being the stratigraphy which varies from very thick deposits of uniform material to thin layers of diverse materials. These types of layering depend, of course, on the vagaries of fluvial deposition. A systematic arrangement of these stratified materials provided us with the first element of the classification of these soils.

The next significant factor is the texture of the surface soil material and this forms the second element in the classification. Together these categories form mappable soil associations within the landform. The justification for basing the whole system on the texture of the materials and their arrangement in layers is simply that the bulk of the agriculture of Pakistan is based on irrigation and the main criterion for determining the suitability of the soil for irrigation in these level alluvial plains is permeability. The permeability is a function of these two factors, structure being confined only to a fine granulation in some soils and when present this was taken into account as part of the apparent field texture. By far the predominant material making up the textural class is silt, the commonest soils being silt loams followed by loams and silty clay loams except in desert areas of aeolian origin and along active flood plains where fine and very fine sands occur, Figure 4.

Soil Legend

Stratigraphy *(0 to 4 feet)*	Field Textural Class *(Surface Materials)*
A. Profiles consisting of coarse to moderately coarse materials	1. Coarse Materials
B. Profiles consisting of medium to moderately fine materials	2. Moderately Coarse Materials
C. Profiles consisting of fine materials	3. Medium Materials
D. Profiles consisting of layers of coarse to moderately coarse and layers of medium to moderately fine materials	4. Moderately Fine Materials
E. Profiles consisting of layers of coarse to moderately coarse and layers of fine materials	5. Fine Materials
F. Profiles consisting of layers of medium to moderately fine and layers of fine materials	
G. Profiles consisting of layers of coarse to moderately coarse and medium to moderately fine and fine materials	

6. Water and Salinity:

The further the work progressed the more it became apparent that the soil *per se* was one of the less important factors as far as land use was concerned. In an arid climate, water is, of course, the limiting factor. The five great rivers which provide the life-giving water on which Pakistan agriculture depends are the Indus, the Jhelum, the Chenab, the Ravi and the Sutlej. The distribution of water from these by way of the extensive canal systems is largely governed by topography.[2]

[2] See categories 4a, 4b, 4c, of Land Use Legend.

Also related to landform, and of great importance, is the level of the ground water. It may seem paradoxical to say that in an arid region where water is such a valuable asset, a high water-table often creates a critical problem. A characteristic of most arid areas is the presence of a high proportion of salts in the soil material, sometimes with a high pH. A water-table within fifteen feet of the surface allows capillary water to carry dissolved salts upward and to deposit them at the point of evaporation. Wherever this point is at or near the surface, the concentration of the salts inhibits plant growth. The rise in water-tables in several areas of Pakistan has been induced by many years of irrigation, no provision for drainage having been made when the systems were designed and installed.

7. Present Land Use:

Concurrent with the investigations of the physical land conditions in the field, extensive observations were made of the present use of the land. It was not until more than half-way through the survey that the land use legend was finally evolved. The party kept an open mind on this matter until there was little doubt that all possible kinds of use had been seen and we were in a position to decide which were of major and which were of minor extent and importance.

The classification established by the Committee on World Land Use Survey of the International Geographical Union was accepted as a basis for the system. However, the sub-divisions recommended therein were early abandoned as being unsuited to Pakistan conditions. While retaining the main headings the following legend was formulated:

1. Settlements and Associated Non-Agricultural Lands
Urban land, airfields, military installations, industrial developments, etc.

2. Horticulture
Market gardening of vegetables and fruits (Included in Class 4).

3. Tree and Other Perennial Crops
Orchards and groves of citrus and deciduous fruits, mangoes, dates, etc.

4. Cropland
Cultivated land, including fallow.

4a Perennially Canal Irrigated
Land irrigated from canals throughout the year.

4b Seasonally Canal Irrigated (Considerable Well Irrigation)
Land irrigated during high-water period by non-perennial or inundation canals; part of this land dry cropped during low-water period, part well irrigated.

4c Seasonally Canal Irrigated (Inconsiderable Well Irrigation)
Land irrigated during high-water period by non-perennial or inundation canals; with or without dry cropping during the low-water period.

4d Seasonally Flooded
Land seasonally inundated by river overflow; primarily winter cultivation with or without well irrigation; limited summer cropping.

4e Torrent Watered
Land dependent on torrent water guided and trapped by bunds.

4f Dry Cropped
Land dependent on natural rainfall for water supply.

4g Well Irrigated
Land irrigated from Persian or tube wells.

5. Improved Permanent Pasture (Managed or Enclosed)
(Not applicable to West Pakistan)

6. Unimproved Grazing Land
Land with natural vegetation used for grazing, browsing and fuelwood.

6a Grassland
Land with grass cover; little or no scrub growth.

6b Scrubland
Land with stunted tree and shrub growth.

6c Semi-Desert
Land with sparse scrub vegetation, arid, sandy.

7. Woodland
Land producing wood for fuel or lumber.

7a Reserved Forest
Government-owned land on which cutting of trees and grazing are controlled.

7b Other Woodland
Natural woodland on which cutting of trees is unrestricted.

8. Swamp and Marsh
Fresh or salt water areas used for fishing, hunting and grazing.

9. Unused Land
Presently unproductive land with or without potential productive use.

With the aid of the field observations, some local data garnered from the Pakistan municipal offices and blueprint maps of all irrigation systems, the present land use has been mapped entirely by photo-intrepretation in the Company laboratories in Toronto. The degree of detail and its accuracy far exceeds that anticipated at the beginning of the project.

It should be stressed that all criteria recognized and mapped during the survey are features which can be discerned by stereoscopic examination of the photographs and in fact all boundaries were drawn by this means on the photographs after a thorough study of the meaning of the photo tones and patterns in the field in every region and on every kind of terrain.

As a result of this Colombo Plan project, Pakistan will be presented with 32 map sheets in the Geology series, 25 map sheets in the Landforms and Soils series and 25 map sheets (of the same area) in the Present Land Use series, reproduced at a scale of 1:253,440 by the Canadian Government, accompanied by two comprehensive reports. The value of this material to the future development of Pakistan is not inconsiderable.

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Some New Developments in Soil and Water Conservation Research

Figure 1. Bulkhead placed in canal for conducting test.

Seepage Measurement and Its Relation to Drainage and Canal Lining Programs

By A. R. Robinson

IN DETERMINING the economic feasibility for undertaking canal lining programs for the reduction of water losses due to seepage, it is necessary to have reliable methods of seepage measurement. In many cases drainage problems arising from canal seepage can be controlled by linings rather than installing drainage systems. Water saved and land reclaimed through a comprehensive lining program can, in many instances, pay for the cost of linings in a few years. Seepage measurements will show what sections of canals are losing a great amount of water. In this manner, it is possible to locate the reaches where seepage losses are significant and linings are needed rather than blindly lining the entire canal length. It is also desirable to determine if a proposed canal should be lined or left unlined before the canal is constructed.

These are some of the conclusions reached after study of canal seepage problems over a period of years at Colorado A & M College, Fort Collins, Colorado. This research is cooperative between the Agricultural Research Service, the Colorado Agricultural Experiment Station, and the Bureau of Reclamation.

There are many factors that affect the amount of seepage from a canal. The most important factor is, of course, the type and structure of soil material through which the canal passes. Other less important factors are the depth of water in the canal, the depth to ground water, the amount of silt carried by the water and the related factors of scour or deposition in the canal.

Various methods of measuring seepage have been devised which are adaptable for use in the field or laboratory. However, many of the methods are not adaptable for general field use. Some of these methods yield results which give the average seepage for a section of canal. Other methods give the seepage rate over a small area or merely furnish information as to the permeability of a sample of the canal bed material.

The methods of measuring seepage now in use include ponding tests, inflow-outflow measurements, records of water diversions and deliveries, well permeameter tests, seepage meter tests, laboratory permeability tests, and piezometric surveys. Of these methods, the ponding tests give the most reliable results. Laboratory methods used to assess permeability of bed materials require additional field observations to determine the hydraulic gradient of water in the soil.

Ponding Tests. Ponding tests are usually expensive to perform and take the canal out of operation for the period of the test. For this reason the tests generally are performed at the beginning or end of the irrigation season. It is necessary to construct dams or bulkheads at either end of the section to be tested and to install gages to record the drop in water surface. The section should be filled several times with pumps or by letting water in through the upper dam in order to allow the canal section to become saturated before the tests are made. If this is not done the test will show seepage rates much higher than those occurring under normal use. Figure 1 shows one of the bulkheads placed in a canal in order to conduct ponding tests.

Inflow-Outflow Measurements. If the seepage losses are moderately high, inflow-outflow measurements may give fairly accurate estimates of seepage. This method entails the measurement of the inflow and outflow from a section of canal either by current meter measure-

Figure 2. Well permeameter used for making seepage estimates.

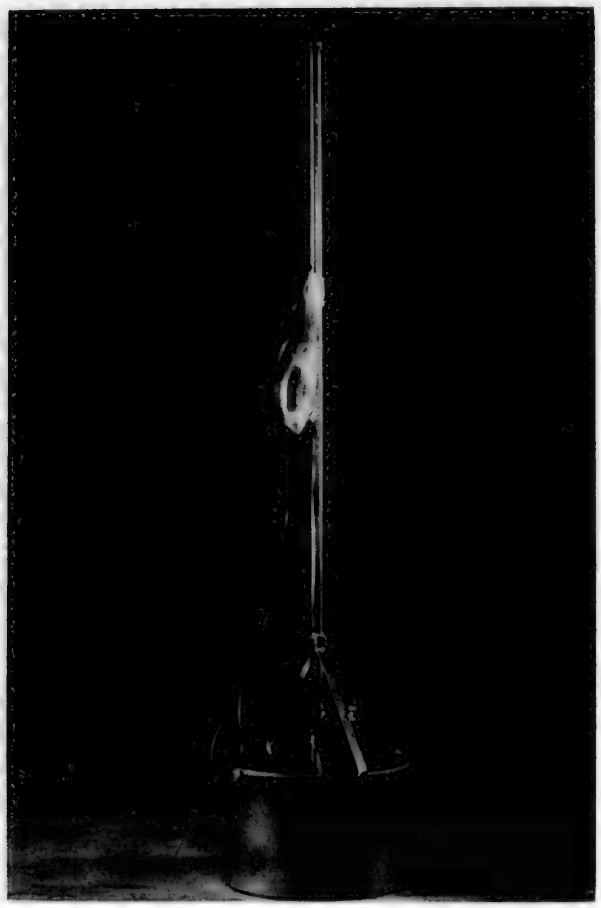

Figure 3. Seepage meter with plastic bag water reservoir.

ments or by weirs or flumes. An accurate determination must be made of all waste inflow and turnouts in the section. The canal must be kept at constant stage previous to and during the period of test.

Well Permeameter Tests. Well permeameter tests are made to predict the seepage losses which may be expected after a proposed canal is constructed. This device measures the rate at which water seeps from a small well which is drilled in the soil along the centerline of the proposed canal. The wells are drilled at frequent intervals along the canal and estimates of seepage losses can be made from observations of the water losses from these wells. The wells are placed to a depth which generally coincides with the elevation of the bottom of the canal. Well permeameter tests are conducted using equipment as shown in Figure 2.

Seepage Meter Tests. Seepage meter tests yield results representative of only a small area of the canal. Figure 3 shows an improved type seepage meter used by the U. S. Bureau of Reclamation. The meters are installed by pressing the bell into the canal bed. The meters should be installed at frequent intervals and should be placed in the sides as well as the bottom of the canal. The meters should be left in place for several days to provide reliable data. As many tests as are economically feasible should be made in a section to determine the average seepage rate. Tests have shown that seepage meters, although not being an accurate method of measuring seepage, do indicate the general magnitude of losses.

Laboratory Permeability Tests. Permeability tests can be made of the material comprising the bed of the canal in order to make estimates of seepage from operating or proposed canals. These are laboratory tests and in many cases laboratory facilities are not available for use by operating personnel. The tests consist of determining the permeability of soils taken from canal banks and beds and converting the permeability to a seepage rate over the area of the canal. This method is at best an estimate and requires, in addition, a piezometric survey to determine hydraulic gradients.

Seepage Experiments

Seepage measuring methods have been employed at Colorado A and M College to evaluate research in developing a new type of canal lining. This lining process consists of adding high swelling bentonite clays to the canal water. The mixture penetrates into the canal bed and seals the soil. Seepage measurements have shown that this method is an economical and effective method for reducing seepage losses in certain types of soil.

A seepage survey was recently conducted in the Grand Valley of Colorado. This survey, which covered a portion of the main canals in the area, was conducted for the purpose of determining the contribution of main canal seepage to high water table conditions. Much of this area which was formerly highly productive has gone out of production due to ground water and resulting alkali conditions. The geological conditions are such that natural drainage has not been able to handle the excess ground water. It was suspected that canal seepage was contributing to the conditions in the area.

The study was conducted using the inflow-outflow method supplemented with seepage meter measurements. Duplicate current meter measurements were made at either end of canal reaches varying in length from one mile to five miles. The measurements were made at stations where flumes were in place or where the section was as uniform as possible. It was necessary to measure all turnouts and waste inflow into the sections at the same time that the current meter measurements were being made. Seepage meters were installed in the canal bottoms at intervals of about 500 feet.

It was found that the seepage losses from the canals were relatively low, being in the range from 0.5 to 1.0 cubic foot per square foot per day. In some cases, an increase in flow was measured over sections which indicated

that these reaches were acting as drainage ditches and intercepting ground water. Seepage meter tests generally gave results which showed losses which were lower than measurements made by the inflow-outflow method. It was observed that in some cases the canals were losing water through seepage but ground water inflow was of such magnitude that actual gains were measured.

From this study it was concluded that seepage from main canals was probably not a significant factor in contributing to the high water table in the area. However, it has been suspected that farm laterals may be a major contributing source of seepage and ground water. A further objective of these studies will be seepage determinations on farm laterals.

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Influence of Deep Tillage on Intake and Storage of Water

By R. J. Hanks and F. C. Thorp

GREAT PLAINS FARMERS have long been interested in deep tillage to conserve moisture, by increasing water intake into the soil. They have had little factual data to support their interest but have tilled considerable acreage with a wide variety of chisels and sub-surface sweeps. Experiments were set up at several locations in Kansas beginning in 1952 to determine the influence of deep tillage on intake and storage of water. So far, the results have been negative.

In July of 1952 a test was initiated in Finney County on a fine sandy loam with a distinct plow pan. Soil moisture measurements made since then have showed no increase in moisture storage due to deep tillage. Tests made using an infiltrometer in 1954 and 1955 have shown no increase in the infiltration rate of water. Wheat yields in 1955 were 11.3 bushels per acre on the check plot, 39.4 bushels per acre on the chisel plot, and 39.5 bushels per acre on the sub-surface sweep plot.

Similar experiments were set up in 1954 in Geary County on a silty clay loam with a tight subsoil, in Clay County on a clay loam, and on a Keith silt loam in Thomas County. In 1955 an experiment was set up in Pratt County on a very fine sandy loam with a clay pan. The results of infiltration measurements made in 1954 and 1955 indicated no difference in infiltration rate due to deep tillage. Infiltration measurements were made on the Pratt, Geary, and Clay County plots within a month from the date of tillage. The yield of wheat on the Geary County plots in 1955 was 30.4 bushels per acre on the check plot and 32.7 bushels per acre on the chiseled plot.

Measurements of soil moisture storage and infiltration of water have indicated no difference in moisture intake or storage due to deep tillage. Likewise there has been no increase in wheat yields due to deep tillage.

R. J. Hanks and F. C. Thorp are agents (Soil Scientists), Western Soil and Water Management Section, Soil and Water Conservation Research Branch, ARS, USDA, Manhattan, Kansas, and Kansas Agricultural Experiment Station, Cooperating.

Transplanters Work With Zoysia Too

By C. S. Britt, C. S. Slater and W. W. Steiner

MODERN EQUIPMENT that is used to transplant cabbage, tomatoes or tobacco applies water to each and every plant. Common sense recommends the same procedure for transplants of *Zoysia japonica*, one of the better grasses for waterways from New Jersey south. It makes a tough sod, requires a minimum of maintenance, and is not apt to become a pest. Water at transplanting time insures a catch and makes a little Zoysia go farther. Just now, Zoysia stocks are in short supply.

Different methods of transplanting Zoysia were tried at the Beltsville Research Center. Two series of experiments were performed. In the first experiment Zoysia sprigs were spread by hand at three different rates on fallow land prepared in four different ways:

1. Zoysia sprigs spread by hand, land then disked and cultipacked.
2. Land disked, zoysia spread, followed by disking and cultipacking.
3. Land furrowed with springtooth harrow, zoysia spread, land then cultipacked.

Figure 1. Close-up of Zoysia sprigs prepared for planting.

Figure 2. *Left:* Cut sods of Zoysia, transplanted with water in an increase plot get off to a good start. *Right:* Once established, Zoysia waterways are erosion-proof. Note the spread of Zoysia to the uncultivated terrace ridge at left, and its complete absence from the cultivated field below the terrace.

4. Land furrowed with springtooth harrow, zoysia spread, land then disked and cultipacked.

The plots were planted in May 1954. The zoysia sprigs from two, four, or six square feet of sod were used to plant 150 square feet of plot area.

The weather that followed planting was dry and none of these plantings was satisfactory. Growth was about the same under all treatments. The higher rates of planting gave the better stands as indicated below:

Sod used (1954).....	two sq. ft.	four sq. ft.	six sq. ft
Zoysia cover (1955).....	12%	17%	20%

A tobacco planter was used in the second experiment in comparison with various mulch treatments. This experiment was also put in in May 1954. Sprigs were dropped in furrows made with a springtooth harrow and footpressed into the soil on all plots except those planted with the tobacco planter. The plots were cultipacked after the sprigs were dropped. Sprigs were spaced approximately one foot apart. This corresponds to the middle rate of planting in the first experiment. Ryegrass was seeded in some of the plots. Some of the treatments and results are as follows:

Treatment	Zoysia Cover *(August 1955)*
No mulch	25 per cent
Soil surface sprayed with asphalt emulsion[1]	27 per cent
Hay mulch[2]	42 per cent
Ryegrass + mulch[3]	27 per cent
Tobacco planter, no other treatment	90 per cent

[1] One gallon asphalt emulsion to 50 square feet.
[2] Two tons per acre.
[3] Seeded at 40 pounds per acre.

The tobacco planter, which supplied water at transplanting, gave outstandingly better results in comparison with any other treatment.

Other differences in results involve mulching. An asphalt mulch did not improve Zoysia growth, but did hasten the germination of crabgrass. Hay mulch increased the growth of Zoysia but mulch and ryegrass in combination did not. Apparently the ryegrass benefited more from the mulch than did the Zoysia and offered too strong a competition to its growth. It was observed that Zoysia was retarded on the plots wherever competition from crabgrass was severe.

The broadcasting of Zoysia sprigs was highly unsatisfactory and was wasteful of planting material.

C. S. Britt and C. S. Slater are, respectively, project leader and senior soil scientist, Soil and Water Conservation Branch of the Agricultural Research Service. W. W. Steiner is plant materials specialist, with the Soil Conservation Service.

What's Going on With Legume Inoculation

By Lewis W. Erdman

OVER THIRTY YEARS of study and work with legume bacteria convinces me that legume inoculation problems are likely to be with us just as long as legumes play a conspicuous role in our national agricultural economy. Whether legumes are grown for seed, in rotations, or for soil and water conservation, inoculation problems are bound to occur. More particularly is this true with specific legumes introduced in new areas having peculiar soil, water and climatic conditions. There is, therefore, a need for more research on certain factors affecting the legume-bacteria relationship.

Experience has shown that the quickest, safest and cheapest way to inoculate legumes is to apply to the seeds, immediately before planting, an effective culture containing the proper kind of legume bacteria. Such

cultures, or inoculants, are generally available through seed suppliers. Under the supervision of competent bacteriologists, they are prepared to include tested, proven strains of bacteria for all of the commonly grown legumes. Farmers have found that these commercial inoculants are generally satisfactory. The great majority of legume growers know the value and advantage of inoculation. It is a well recognized practice, and usually pays big dividends for the money expended. Sometimes difficulties in getting a "catch" of inoculation are encountered, and herein arise some of the problems.

Figure 1. Inoculated crimson clover plots on either side of two uninoculated plots to the right center. Photo of one of the uniform inoculation experiments in cooperation with the Virginia Agricultural Experiment Station.

One objective of research on inoculation of legumes in the Eastern Soil and Water Management Section, SWCRB, Agricultural Research Service, U. S. Department of Agriculture, is to discover the causes for legume inoculation failures and ineffectiveness of inoculation on farms. Uniform legume inoculation experiments have been established in the Eastern and Southeastern states to find the answers to some of these problems. This work is cooperative with the State Agricultural Experiment Stations. Variables under study are source of inoculants, moisture, methods of application and the use of nitrogen fertilizer at the time of seeding. Legumes under study include alfalfa, sweet clover, crimson clover, white clover, ladino clover, birdsfoot trefoil, lupines and soybeans. Mixtures of several commercial inoculants have compared favorably with inoculants prepared with highly effective strains of bacteria in the Beltsville laboratory.

Inoculated Legumes Require Moisture

At Watkinsville, Georgia, and the South Carolina Experiment Station, evidence is being obtained showing the importance of moisture in getting inoculated legumes established. Many legume failures can be traced to planting inoculated seeds in dry soil. It has been found that an adhesive, like syrup, to mix the inoculant with the seeds, has definite advantages in maintaining the life of the bacteria for a period of two to three weeks. If rain does not come by the end of this time it is advisable to reinoculate the soil. One experiment cooperative with the North Carolina Experiment Station showed that when a ten per cent syrup solution was used on alfalfa seeds planted in dry soil in September, a yield of 1915 pounds of dry alfalfa hay was obtained, where water only was used 1040 pounds of dry alfalfa were harvested. In Florida, inoculation increased the yield of Roanoke soybeans 82.2 per cent over the uninoculated control treatment. The use of 34 pounds of nitrogen per acre at planting did not increase the yield significantly over the control. At the Marcellus Station in New York, birdsfoot trefoil responded to nitrogen fertilization at planting time regardless of whether or not the seeds were inoculated. Greater yields, however, were obtained on the inoculated plots. Although the uniform legume inoculation experiments were planned for a period of five years, the variables are changed from time to time as conditions warrant. In this way quicker answers should be obtained to some of the inoculation problems.

One phase of the work on legume bacteria in the Soils and Plant Relationships Laboratory at Beltsville, involves the search for new and more effective strains of legume bacteria. Such strains are needed not only for the more commonly grown legumes, but also for newly introduced legumes. The present legume bacteria bank of stock cultures contains more than 1200 single strains. Most of these have been tested on their host plants. Many are discarded each year and other new isolations are added to the collection, usually after they have demonstrated their effectiveness or superiority over the older strains.

There are different sources and means whereby new strains may be found and isolated. For a number of years close cooperation has existed between the Soil Conservation Service and the U. S. Department of Agriculture. Workers at the various SCS nurseries scattered over the United States, have gathered nodulated plant roots and sent them in for isolation purposes. A number

(*Continued on page* 88)

MANAGING THE FARM BUSINESS. By Raymond R. Beneke. *John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, New York. 464 pages. 1955. $3.96.*

This highly practical farm-management textbook combines principles with realities in a readable fashion. In his preface, Beneke states, *"This text has been prepared primarily for students in vocational agriculture in secondary schools and for students in junior colleges and agricultural institutes. Farm operators interested in improving their business should also find the book helpful."* The author has done a splendid job of writing for these groups.

Beneke's book consists of 21 chapters. The beginning chapter deals with the role of management in the business. Others include such topics as getting established in farming, leasing, buying, and uses of credit; use of soil resources, including cropping and conservation measures; planning and managing the livestock program; use of power, machinery, labor and buildings; marketing; risks in farming; size of business; and lastly, farm accounting and analyzing the farm business.

The organization and style of the book are appealing. Each chapter outlines the management problems involved in the subject treated, and includes discussions, illustrations, examples, and problems plus an excellent list of references. The many pictures, charts, and figures, with their explaining captions, help to make the text interesting and to tie in economic principles with everyday farm management decisions.

Beneke recognizes other factors besides economics have a part in the successful management of the farm business. He discusses such problems as getting started in farming, farm family living and its effect in making management decisions, landlord-tenant and operator-laborer relationships, and the welfare of the farm compared with the needs of the farm business in farmstead planning. His discussion of how to improve farming on rented farms is excellent.

Conservationists and those interested in conservation should be particularly pleased with the chapters on *"Planning the Cropping Program,"* and *"Fitting Soil Conservation Measures to the Farm."* Likewise, the chapter on *"Using Budgets in Farm Planning"* will be welcome. In fact, a salient feature for many of those in conservation work who must interpret farm management and agricultural economics material for others, along with their teaching of conservation practices, is the helpfulness of Beneke's terminology.

This reviewer believes that the author could have dealt more adequately with specialization in livestock enterprises, that is, with the current trend toward fewer and larger livestock enterprises with their resulting economics. The chapter on size of business overlooks the possibilities of expanding the farm business by more widespread use of known and proved practices that increase yields per unit (per acre, per cow, etc.).

Professor Beneke's cogent book meets adequately the purpose for which it was prepared. It should also receive the attention of others interested in the complex business of farm management.

—E. L. Sauer, *Champaign, Illinois*

SOME LEGAL ASPECTS OF WATER USE IN DELAWARE. *Technical Bulletin Number 314.* By Harold E. Ellis and R. O. Bausman. *University of Delaware. 1955.*

This work begins by pointing out the increased need for water for municipal, home, and agricultural uses, such as for irrigation, as giving rise to increased interest in water rights. The matter of legal bases underlying the rights to use water is complicated at best. Heartening it is to see this subject tackled for Delaware, where the water subject usually heard about has been limited to the handling of excess water or drainage.

This work represents a highlight resume of legal considerations—law and court decisions regarding the use of water in Delaware. Among the points mentioned are the limitations of the present legal background to give the water user, or prospective user, a clear-cut basis for moving forward, trouble-free.

Basic water right doctrines are described. Delaware laws, which, among other things, affect the right to use water, are mentioned. Key court decisions concerning water rights are discussed.

Free reference is made to the writings of Mr. Wells Hutchins, Production Economics Research Branch, ARS, USDA, including "Selected Problems of the Law of Water Rights in the West," USDA Miscellaneous Publication 418 (1942). The bulletin is well outlined by ten major titles, with appropriate subtitles under each.

The study should form a helpful background for the work of Delaware's Water Resources Study Committee, established by the governor in 1954, to make recommendations as to what, if any, legislative action relating to water might be necessary in the public interest.

—T. L. Gaston, *Washington, D. C.*

VEGETABLE PRODUCTION AND MARKETING. BY PAUL WORK AND JOHN CAREW. *537 pp. Illustrated. 1955. New York: John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. $4.75.*

Here is a book on vegetable production and marketing which should be of interest to soil conservationists, particularly those who work in vegetable growing areas.

It fills the need for a comprehensive book on vegetable growing, since much of the more recent information is scattered in many periodicals and journals. It is easily understood. The information is based on science and actual grower experience and is presented in such a manner that one may make his own decisions according to the conditions prevailing locally. Specific directions have been minimized, since the authors state that *"the book is not like a set of instructions for setting up a new piece of machinery."*

The chapters are organized in a logical, orderly manner—from a general chapter on the vegetable business and its place in life and agriculture, through chapters concerning all phases of production, management, and marketing, to a series of chapters on specific important crops. Each topic is a unit in itself, and the book lends itself to ready reference.

Inherited characteristics of the crop plants and their responses to various conditions of environment are stressed in such a manner that the information gained may be applied anywhere.

The erosion hazard is emphasized in chapters dealing with soils and land management.

There is a wealth of information for the farm planner whose task is to help growers make use of a conservation plan which fits their type of business under local conditions.

—RALPH WORK, *Fonda, New York*

HOW TO DEVELOP WATERSHEDS. *Prepared by* S. L. FROST, *Ohio Forestry Association, Inc., Columbus, Ohio. 35 pages, illustrated. 1955. $1.00*

VALLEYS OF OPPORTUNITY. *Prepared by* S. L. FROST, *Ohio Forestry Association, Inc., Columbus, Ohio. 64 pages, illustrated. 1955. $ 3.00.*

Not long ago a competent, friendly reporter said he was working up a story to explain to his audience "how to form watersheds."

You might think the Ohio Forestry Association, Inc., had overheard this well-intentioned but somewhat misstated objective. For OFA has come out with a publication that tells, instead, How To *Develop* Watersheds. As a matter of fact, that is the exact title of this effectively organized 35-page handbook. The step-by-step information, ideas and aids should be of real help to every watershed group in the country.

After outlining and organizing the basic and practical considerations that concern any watershed activity, the book lists the major Ohio watersheds and other information for the special benefit of readers and users in the state. It passes on, briefly, watershed development experiences from many other states and even offers a practical list of "mistakes to avoid."

Besides the skillful job of telling how to *develop*, rather than to *form* a watershed, the book helps straighten out some other fairly prevalent misconceptions that have developed since, as this publication explains, watersheds have become "the 'style' in conservation circles."

One of these is the relationship between watershed activities and other resource conservation and development efforts. This OFA handbook shows convincingly that the watershed movement cannot be a duplicating conservation program. Rather, it *"offers an opportunity for molding into a common purpose the earnest endeavors and skills of many groups without stripping away anyone's just share of the credit."* The book does more than say this. It offers concrete ways—"Who," "how," "when," "where" . . . to put to work the knowledge, skills, energy and enthusiasm of practically every group and agency in the watershed community.

The handbook outlines, and then develops, five major steps in promoting a successful program of action in a watershed: *diagnose, organize, survey, plan and act.*

What makes this offering all the better is that the Ohio Forestry Association and its many cooperators and counsellors are not only preaching these principles, but have taken another step towards practicing them as well.

Paralleling *How to Develop Watersheds* they have produced another top-notch publication, beautifully designed and clearly written, entitled *Valleys of Opportunity, the Watershed Conservation Plan for Ohio.*

OFA catalogues this publication modestly as "64 pages of colored maps, charts, facts, on the major watersheds in Ohio; plus a list of agencies and organizations; a plan. A useful book for local watershedders."

That terse tag fails to reveal that these 64 pages, with help of some excellent modern graphics, represents a $40,000 expenditure by the association and its contributors. More important, it presents the findings and recommendations of a full year of work by an able steering committee, six competently-staffed task forces, and a treasure of data compiled by OFA's own staff.

Leaders and experts from Ohio's business, industry, agriculture, education, science and government served on this committee and these task forces. They have brought to bear in this study an extraordinary wealth of background and experience in land and water resources. Their separate, more lengthy task force reports are also available in mimeograph form, OFA says. But their principal findings and recommendations, together with graphically

presented data on land and water use, population, industry, weather, economics, and many other aspects and needs in Ohio's resource picture, have gone into this report. Helpfully, these data have been broken down in terms of Ohio's 14 major watersheds. The report was financed, cooperatively, by a number of businesses, industries and foundations.

The value of these two publications lies first in the solid help they offer to Ohio watershed groups. But their value is broader than Ohio, too. For they set a high standard and example for other states where hundreds of local watershed groups are waiting for and needing similar guide posts to successful development of their watershed resources.

—HARPER SIMMS, *Washington, D. C.*

MAN AND THE WINDS. BY E. AUBERT DE LA RUE, *translated by Madge E. Thompson. Philosophical Library, New York. 206 pp., illus. 1955.*

Few elements of man's environment mold his habits or capture his imagination more than the wind. Yet, few of us are any more conscious of the dominating role in our lives of "air in motion" than we are of the air we breathe. Here is a book devoted exclusively to this one element of the climate.

It is a fascinating story. The different kinds of winds are classified. Individual winds of particular localities, each with its own name and peculiar characteristics, are described. Among the better-known examples are the *föhn* of the Alps, the *mistral* of Provence, the *sirocco* of North Africa, and the *chinook* of the American northwest. Scores of others are equally unique.

The physiological effects of winds on people, their influence on human habitations, on commerce and transportation, and their use as a source of energy are among the utilitarian aspects of the subject discussed. The European background of the author is evident in the selection of examples and in the underlying viewpoint of discussion.

A chapter is devoted to soil erosion by the wind and another to the peril of dunes. The conservationist will find these too elementary to be of significance, however.

In fact, the entire book is more on the order of lore than of science. The style, in the translation, is simple and easy to read, as befits such a book.

—BEN OSBORN, *Washington, D. C.*

Seeing America's Wildlife—*in Our National Refuges.* BY DEVEREUX BUTCHER. *The Devin-Adair Company, 23 & 25 East 26th Street, New York 10, New York. 338 pages, illustrated 1955. $5.00.*

Here is a book that describes 41 National wildlife refuges and a number of other areas. It is illustrated with 350 superb photographs of birds, mammals and scenic views.

The author, a field representative of the National Park Association and editor of NATIONAL PARKS MAGAZINE states in the foreword that "Increased public esthetic appreciation and enlightenment on wildlife problems are essential to the fruitful outcome of any program for the preservation and protection of North America's wildlife heritage. To bring this about is one of the pressing duties of informed people everywhere today."

Mr. Butcher believes wildlife refuges need to be better known by the public. He also feels that we have a moral obligation to make certain that our activities are conducive to the survival of all forms of wildlife. The present system of wildlife refuges represents a good start in this direction. However, the author points out that many more are needed—especially in the lowland sections where drainage is destroying natural swamps and marsh areas.

Agricultural Conservation Program—*Summary for 1954.* AGRICULTURAL CONSERVATION PROGRAM SERVICE, *USDA, Washington 25, D. C. 93 pages. 1955.*

This summary contains the accomplishments of farmers and ranchers under the 1954 Agricultural Conservation Program, on a state-by-state basis. The booklet also includes data with respect to participation and assistance for certain selected practices, including 1936-1954 accumulative totals.

Rural Water Supply and Sanitation, *2nd edition.* BY FORREST B. WRIGHT. *John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, New York. June, 1956. $4.90. 388 pages.*

Almost entirely rewritten, the book includes the newest and most important developments in the field of water supply and sewage disposal. The first section deals with the rural home and farmstead and the second half concentrates on laboratory and field work.

African Soils. *Published by* THE INTER-AFRICAN INFORMATION BUREAU FOR SOILS AND RURAL ECONOMY, *57, Rue Cuvier, Paris 5, France.*

This quarterly publication is issued by the Inter-African Bureau of Soil Conservation and Land Utilization. Each article or item is printed in English and French. The purpose as pointed out by the publisher . . . "is for the use of all persons or organizations—specialists, research organizations and official services—that are endeavoring to arrest the degradation of the soil in Africa and to promote the adoption there of agricultural methods based on principles of soil conservation."

A review of the contents for Volume III shows that subjects presented are somewhat similar to those that might appear in similar publications in the United States.

WATER—*The Yearbook of Agriculture for 1955.* BY THE UNITED STATES DEPARTMENT OF AGRICULTURE. *Superintendent of Documents, Washington 25, D. C. 751 pages, illustrated. $2.00. 1955.*

The United States Department of Agriculture Yearbook for 1955 is entitled "Water." It contains a wealth of information on all aspects of a subject that has become a major national concern—for industries, city people, foresters, conservationists, gardeners, and sportsmen, no less than for farmers, ranchers, and orchardists.

Its 95 chapters were written, mostly in nontechnical style, by 149 specialists in the Department of Agriculture, state agricultural colleges and divisions, and private and federal organizations whose work pertains to water. The book has many drawings, maps, and photographs.

Among the subjects treated are: The importance of water in history; the need of water for people, animals, and plants; weather cycles; "cloud seeding"; desalting sea water; water and erosion; the care of watersheds; water laws; floods and their prevention; water for forests and range lands; irrigation in the West and East and for specific crops; drainage; managing watersheds for better fishing; wetlands and waterfowl; farming in dry regions; use of waste water by industries; water for gardens and lawns; pure water for rural homes; sewage disposal; teaching and learning about conservation, and research regarding water.

In the foreword to the yearbook, Ezra Taft Benson, Secretary of Agriculture, writes about the challenge before us: "We have to know where water comes from and what happens to it. We have to know how much can be used and when, and how our land practices influence its behavior.

"We have to stop wasting water. We have to use it more efficiently in industry, in towns and cities, in general farming, and in irrigation, which is destined to be adopted in all parts of the nation.

"We have to learn more about the control of floods at their sources as well as in the big rivers. That will take county, regional, and national planning—much more planning for the future than we have ever done.

"We have to look to the fields, the forests, and the hills that make up our watersheds, for the way we manage them affects the abundance and purity of the water farmers and city people need in increasing quantities . . .

"We need an increased awareness among all Americans of the oneness of our physical resources. Just as many lives make up our one national life, so our agriculture has many parts of a single whole. Water, land, and people are inseparable components of one thing, our welfare. The subject of water can be viewed from the various aspects of soil conservation, agronomy, forestry, irrigation, wildlife, recreation, business, industry, law, and so on—but never alone."

Recent Conservation Books

Forest and Range Policy—*Its Development in the United States.* BY SAMUEL T. DANA. *McGraw-Hill Book Company, 330 West 42nd Street, New York 36, New York. 455 pages. 1956. $6.50.*

Farm Soils—*Their Fertilization and Management.* BY EDMUND L. WORTHEN AND SAMUEL R. ALDRICH. *John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, New York. 439 pages, illustrated. 1956. $4.96.*

Conserving Soils. BY M. D. BUTLER. *D. Van Nostrand Company, Inc., Princeton, New Jersey. 321 pages, illustrated. 1955.*

Giving Wings to Soil Conservation. *Bulletin No. 11.* BY D. A. CAMPBELL. *Soil Conservation and Rivers Control Council, Wellington, New Zealand.*

Airborne Fencing. *Bulletin No. 12.* BY D. A. CAMPBELL. *Soil Conservation and Rivers Control Council, Wellington, New Zealand.*

New Conservation Films

With Our Own Hands. *Written and directed by the late* C. W. GEE. *Photography by Allis-Chalmers cameramen. Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin. 16 mm., color and sound. Running time, 25 minutes. 1956.*

"With Our Own Hands" is a dramatic story of how farmers and ranchers can join hands in watershed treatment, as authorized by Public Law 566 passed by the 83rd Congress. The film was made in Mills County, Iowa, on the Mule Creek Watershed Protection Project, one of the first of 64 pilot projects to get started under this act. Also, the Mule Creek project, while not fully completed when the picture was made, actually was further along than any other similar project in the Middle West.

Action in *With Our Own Hands* covers the early homesteading of land in Mills County, Iowa, and the evolution of the area into a prosperous agricultural community. This part of the film stars Adolph Schultz, a cooperator in the Mills County Soil Conservation District. Schultz has retired as the film opens and explains that his son, Jim, now operates the family farm near Malvern, Iowa, and helped organize the local soil conservation district.

Son Jim is played by B. Jack Wederquist of Glenwood, Iowa, conservation aid assigned to the Mills County district by the Soil Conservation Service. He then carries the story forward as he and other district cooperators became aware that more than a soil conservation district is needed to control the floods that regularly ravage the cropland and towns in their watershed.

The story of how "Jim" and his neighbors cooperate with the district supervisors, county commissioners, rep-

resentatives of towns, and with the State and the Federal Governments to organize their watershed project, carries the action on to the end of the film when the project is well along toward completion.

Descriptive scenes of actual construction of the various treatments are shown, including an air-tour of the entire watershed. The concluding scene shows "Jim" and his family sitting down at a bountiful meal with "Dad" returning thanks for the many blessings that have come to them and their neighbors as a result of conservation farming and watershed treatment.

Prints of *With Our Own Hands* may be obtained from all state offices of the Soil Conservation Service . . . from Allis-Chalmers dealers and branches . . . and direct from the home office of Allis-Chalmers Manufacturing Company in Milwaukee, Wisconsin.

From The Ridge To The River. *16mm., sound and color. 26 minutes running time. A Soil Conservation Service film. Produced by USDA Motion Picture Service, Washington 25, D. C.*

This film tells the story of local watershed organization. It explains the land treatments and the work on the watercourses and tells how they are integrated to provide watershed protection which will give both farmers and city folks greater security against floods. Several professional actors were used in the production and a real watershed situation has been dramatized to make this film more enjoyable. Cleared for half-hour television showings.

From The Ground Up. *16mm., sound and color. 13 minutes running time. A Soil Conservation Service-National Plant Food Institute film, Produced by USDA Motion Picture Service.*

This is a story of a soil surveyor and the work he does on studying and mapping soils. The part of the soil surveyor is taken by a professional actor who explains the importance of productive soil to the population of the world. He shows how the soil conservationist uses soil survey information in helping a farmer develop his conservation farm plan. Cleared for quarter-hour television showing.

New Research Developments

(*Continued from page* 83)

of different strains of bacteria have thus been obtained for many legume species that are still in the observational stage. A lot of interest in various species of *astragulus* has recently developed. Intensive work is now in progress to find strains of legume bacteria which will effectively inoculate different species of this legume.

Bacteria in Some Nodules Do Not Fix Nitrogen

A recent success in this laboratory was the isolation of new strains of bacteria to inoculate Kura clover or *Trifolium ambiguum.* Until 1954 this clover was known to carry few and small nodules on some of its roots, but judging from color and growth of the plant, the bacteria in these nodules did not fix nitrogen. They were what the bacteriologist calls parasitic—not benefiting the plant in any way whatsoever. In 1953, through the cooperation of the Plant Introduction Section of ARS, one of their plant explorers sent in a number of soil samples and several nodulated root specimens of Trifolium from an area in Turkey where *Trifolium ambiguum* was native. Isolations of bacteria from these nodules, and from nodules produced on *Trifolium ambiguum* plants grown in greenhouse sand cultures inoculated with soil suspensions made with each of seven soil samples, yielded for the first time effective strains for this little known legume. Inoculant cultures were prepared with several of these most effective strains in the Spring of 1955 and sent to agronomists, soil conservation workers and soil bacteriologists, to study the value of inoculating this legume under a wide range of soil and climatic conditions. It is believed that the proper evaluation of a newly introduced legume can not be made unless it is inoculated with its associated legume bacteria. There are, however, still a number of legume species that bacteriologists, so far, have not found an organism which will produce nodules on their roots and fix air nitrogen. Future studies may find these elusive microorganisms.

Another study recently completed has been one on strain variation in which ten single strains of soybean bacteria and a mixture of the ten strains were tested on Jackson soybeans at the Suwannee Valley Station at Live Oak, Florida. One of these strains produced a yield increase 123 per cent over the check or uninoculated control. Five other effective strains produced increases ranging from 31 to 91 per cent over the check. Three strains were ineffective and one was parasitic. The mixture of ten strains was 83 per cent better than the control.

Greenhouse tests made in sand or soil cultures should be supplemented with field tests to make sure that the best cultures under controlled greenhouse conditions will react similarly under field conditions. Such information enables the bacteriologist to select the most effective strains for use in preparing inoculants. As new strains are discovered and developed they are made available to agricultural workers and producers of legume inoculants.

Our goal is to assure availability to the farmer highly satisfactory legume inoculants.

Lewis W. Erdman is a bacteriologist in the Agricultural Research Service and divides his time between the Eastern Soil and Water Management Section and the Soils and Plant Relationships Section, with headquarters at Beltsville, Maryland.

Field Notes

Water Resources Policy Report

The Presidential Advisory Committee on Water Resources Policy, named in May of last year, and consisting of the Secretary of the Interior, chairman, the Secretary of Defense, and the Secretary of Agriculture, has issued its report. It calls for: Accelerated collection of basic data on water; cooperative planning among federal, state, and local agencies; the establishment of a Coordinator of Water Resources to coordinate the work of the federal agencies; the establishment of a Board of Review to analyze the engineering and economic feasibility of projects; the formation of regional or river basin water resource committees; formation of a permanent Federal Inter-Agency Committee of advisory capacity; the recognition of water rights as property rights with federal and state and local entities collaborating on establishment of principles and legal approaches; that no system of relative priorities for use of water should be applied uniformly to the entire country; that evaluations of water projects by all agencies be on a uniform basis; that each major water resources project be separately authorized by Congress; and that as a general policy, all interests share the costs of water projects in accordance with the measure of their benefits, with the federal government encouraging non-federal assumption of responsibility for projects.

Watershed Congress Moves to the Land

The 1956 *(Third)* National Watershed Congress will meet in Lincoln, Nebraska with headquarters at the Cornhusker Hotel on September 18-19. Program details are not yet decided, but to be included is a field inspection of the Salt-Wahoo district. The chairman of the Congress will be Waters S. Davis, Jr., treasurer of the National Association of Soil Conservation Districts. General Committee members are: Charles C. Butler, American Farm Bureau Federation; Raymond McConnell, Jr., Lincoln Journal; C. R. Gutermuth, Wildlife Management Institute, and John H. Jones, American Watershed Council.

Farm Implement Dealers 1956 Conservation Award

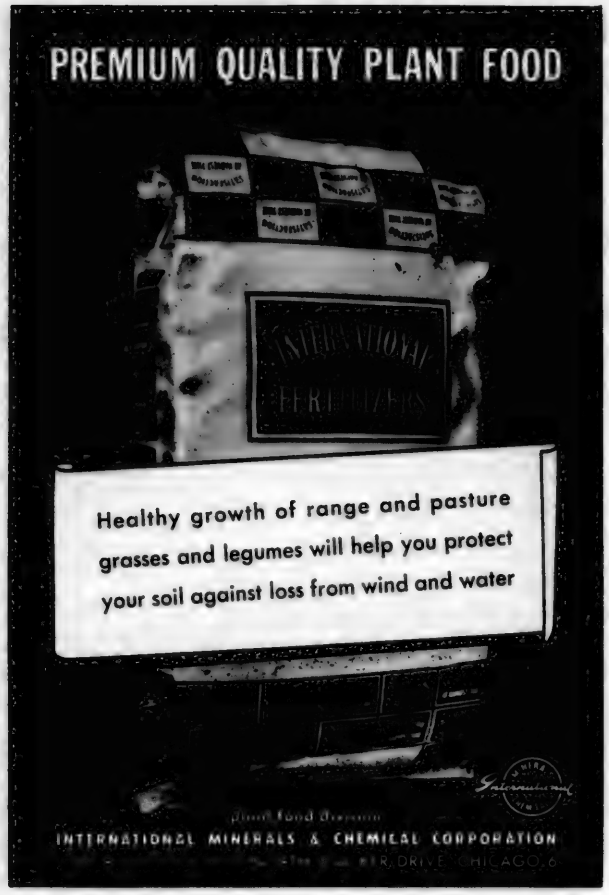
Hundreds of farm implement dealers throughout the nation will soon be displaying attractive three color window decals proclaiming that they have received a *1956 Conservation Award* in the National Dealer-District Program.

The decal is being provided to recognize dealers who are doing a good job of promoting conservation by the National Dealer-District Program Steering Committee whose sponsoring members are the National Association of Soil Conservation Districts; the National Retail Farm Equipment Association and the Farm Equipment Institute.

"The only thing left on this place is an appetite."

The 1956 Conservation Award goes to any farm equipment dealer who is certified as having earned the award in 1956 by performing one of the first three, and any other two of the items four through eight, either in cooperation with his local soil conservation district or by furthering conservation in other prescribed ways.

1. Interview at least five conservation farmers and complete a "How Does Conservation Pay Its Way On Your Farm?" questionnaire for each.
2. Conduct a field demonstration by yourself or in cooperation with other dealers emphasizing the proper application or maintenance of conservation practices.
3. Participate annually in a joint meeting of farm equipment dealers and the district governing body to study ways dealers can help farmers with their conservation work.
4. Maintain a continuous display of conservation book-


PREMIUM QUALITY PLANT FOOD
Healthy growth of range and pasture grasses and legumes will help you protect your soil against loss from wind and water
INTERNATIONAL MINERALS & CHEMICAL CORPORATION

lets, and other material, developed by your manufacturer.

5. Show to a farmer audience at least one of the conservation films produced by your manufacturer.
6. Attend at least two meetings each year of your district governing body.
7. Visit the local or closest district office and familiarize yourself with the district's work plan and latest annual report.
8. Participate in a tour of conservation farms arranged by your district.

Scouts Get $50,000 for Conservation

The National Council of the Boy Scouts of America recently received a grant of $50,000 from the Rockefeller Foundation toward support of a five-year program in conservation education, according to a recent announcement by Dr. Arthur A. Schuck, chief scout executive. The funds are to be used to provide the full-time services of a conservation expert who will give leadership to a newly-expanded program. Ted S. Pettit, who headed the 1954 National Conservation Good Turn, has been named to direct the new program.

The 1954 National Conservation Good Turn of the Boy Scouts, carried out at the request of President Eisenhower, resulted in widespread interest and activity by hundreds of Cub Scouts, Boy Scouts, Explorers, and their leaders. The organization plans to expand further its national conservation education emphasis in an effort to build on this interest created by the National Conservation Good Turn.

Southern Agricultural Workers Hold Annual Meeting in Atlanta

The 53rd Annual Convention of the Association of Southern Agricultural Workers was held in Atlanta, Georgia, February 6-8, 1956. About 1500 people representing a cross section of the educational, industrial, and business interests in agriculture attended the three-day meeting.

The joint session between agronomy, agricultural engineering, animal husbandry, and soil conservation sections in which grassland farming was the theme was attended by more than 800 persons.

The speakers reported on various phases of improving grasslands and the importance of an integrated approach to the total program. R. M. Merrill, from John Deere Company, discussed the improved seeding and harvesting equipment available.

Howard Doane, Doane Agricultural Service of St. Louis, and Dr. G. O. Mott, Purdue University, both reported that wintering steers on hay and silage resulted in more economical gains on pasture the following summer, as compared to a winter ration which produced gains. Also, both types of feeding resulted in about the same grade of cattle.

J. R. Sasser, State Conservationist in Tennessee for the Soil Conservation Service, discussed the importance of the economics in grassland agriculture and the importance of recognizing the problem with low-income farmers.

According to B. D. Blakely, Head Agronomist for the Soil Conservation Service, grasses and legumes are needed in the cropping systems of the South as they help control erosion, provide organic matter, improve the tilth and structure, as well as furnish forage. Farmers should recognize the capability of their soils, and the necessary treatments for protection, improvement and maintenance when planting their cropping systems.

In the Soil and Water Conservation Section, J. E. Pollock, Management Agronomist in Georgia, reported on farmer experiences in using perennial grasses in row crop rotations. Tobacco, corn, cotton, and peanut yields and quality are improved following good sods of Coastal Bermuda, tall fescue and Bahia grass. *Mr. Pollock said that a Bacon County, Georgia, farmer grew his tobacco on 3-year-old Pensacola Bahia grass sod, and reported it was worth $717.00 per acre as compared to $434.00 for*

tobacco grown on similar soil but without the benefit of the grass sod.

J. T. McAllister, Conservation Equipment Engineer, Orangeburg, South Carolina, reported that recent improvements in equipment for seeding grasses and legumes have made it possible to get better stands by planting them at the desired depth. Planting small seeds in a poor seed bed too deep is a waste of seed and will result in a poor stand.

George Sherman, State Conservation Engineer for North Carolina, outlined the Watershed Protection and Flood Prevention program. He stated that the ultimate success of small watershed activities in Soil Conservation Districts depended upon public understanding of the problems and objectives, and upon local participation. Sound conservation measures properly planned and installed for all the land is necessary for satisfactory results.

Swift and Company Features Unusual Exhibit

Right eating as a key to longer, happier life is dramatized for visitors of all ages all over the world in an extensive new exhibit at Chicago's Museum of Science and Industry.

The exhibit, *Food For Life* story begins with an exhibit on soil conservation presented by Swift and Company. Emphasizing to visitors that *"your food begins with the soil"* this exhibit describes how soil must be conserved and re-built nutritionally in order to nourish plants properly for the manufacture of food.

The exhibit shows typical farms having "original soil," "depleted soil," and "re-built soil."

Interest center of the exhibit is a "nursery" for baby farm animals. Here, in a special air conditioned, glass-enclosed area, young pigs, lambs, calves and ducklings are on display at close range. The young animals are fed scientifically balanced rations contained in regular commercial feeds.

Near the nursery is a specially designed glass incubator where chicks or ducklings hatch before the eyes of spectators. The incubator is charged each day with eggs ready to hatch.

School, home economics, women's and agricultural groups find the educational features of the exhibit of particular interest. Various sections portray the roles of soil, plants and livestock in providing food for human beings. Each story is told with the help of colorful three dimensional displays.

The plant section, for example, has an actual miniature farm plot. In this lead-lined "garden," far from any natural sunlight, garden and field crops such as alfalfa and green beans or tomatoes flourish under artificial light. In front of a large sheet of falling water, miniature farms illustrate the effects of good and bad farming practices.

Graduate Training and Jobs for Resource Specialists

The Conservation Foundation is conducting a study of the need for and availability of resource training at the graduate level. Its aims are three-fold: (1) to determine what are the specific areas within business, industry and the professions that need personnel broadly trained in resource management; (2) to stimulate a better understanding on the part of business and industry of the availability and scope of this training, and of the practical value of having personnel so trained; and (3) to encourage the universities to qualify their students to

Figure 1. *Left:* An attendant explains to visitors at Chicago's Museum of Science and Industry how the soil of modern farms is maintained for proper production of food. *Right:* Shown in this photograph is an area where plants actually are grown indoors to illustrate how proper nutrition of the soil is necessary to produce food. Both displays are features of the Swift and Company *Food for Life* exhibit.

Chicago's Newest and Most Convenient
Completely Air Conditioned
Town House
HOTEL
1229 South Michigan Boulevard
NO PARKING WORRIES
Drive right into the garage located in the hotel.
At the doorway of the Loop, on beautiful Michigan Boulevard, ½ block South of Illinois Central Railroad Station. Six floors of luxurious, sparkling rooms and suites just recently completed—everything new! Coffee Shop serving excellent food . . . Cocktail Lounge . . . Television and Radio in room.
Next Door to Everything
REASONABLE RATES
WRITE OR WIRE FOR RESERVATIONS TODAY
CHICAGO

meet specific needs while giving them broad knowledge of all resources and environmental relationships.

The Foundation is implementing the first two aims through active cooperation with appropriate trade associations and selected corporations. To meet the third aim, it is planning to hold a small educational conference in 1956 to be attended by representatives of business, government and those universities with graduate conservation departments.

What is meant by resource training? Perhaps it can best be described by stating the Foundation's concept of its primary objectives. Aside from furthering an individual's general education, resource training at the graduate level is intended to serve two categories of students: (1) those who are training in such technical resource fields as forestry, agriculture, wildlife management, etc., so that they may gain a broader understanding of the interrelationships of all resources and become more effective in their own technical specialty, and (2) those students who are acquiring—or have already acquired—a recognized profession (such as law, economics, engineering or regional planning) so that they may practice their chosen profession *in the resource field.*

The first category needs little explanation; the second, which is of special interest to business and industry, represents an approach to resource knowledge and management that has not been so widely recognized. Although the student in this area must touch sufficiently upon the pertinent technical disciplines to acquire the proper background, his major concern is with man's *relationship* to his resources. In other words, he must not only have a broad understanding of all resources, but he must relate them definitely and specifically to our social, political and, above all, to our economic requirements. It follows that the student who chooses to specialize in the resource field will select a very diversified curriculum. Varied as the choice may be, it is the conservation department itself that maintains the orientation towards resource management.

There are two general classes of business and industry in which this type of training is valuable. The first group includes all those companies that are in direct contact with natural resources,—the wood-using industries, for example.

The second category encompasses all those organizations whose welfare is directly dependent upon the welfare of their local community. Planning organizations, public utilities and banks are outstanding examples in this group.

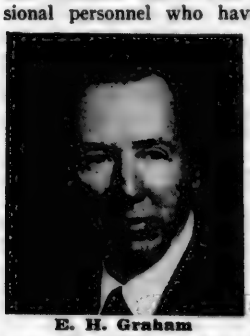
—ROGER D. HALE, *New York*

The Conservation Foundation would greatly appreciate the comments of readers concerning this project and its objectives. They should be sent to the Conservation Foundation, 30 East 40th Street, New York 16, New York. EDITOR.

News Notes

President's Column

The Soil Conservation Society of America has just been accorded distinguished recognition. It is one of seven professional societies out of 155 in the United States that has been invited by the International Cooperation Administration (in charge of United States technical assistance) to enter into contractual arrangement with the United States Government to establish and maintain liaison with foreign professional personnel who have been to the United States for training. In our case the liaison will be with soil conservationists abroad. The Council of the Society, by mail vote, has just accepted the offer of ICA to undertake the program. The SCSA, along with the American Home Economics Association, American Nurses' Association, American Public Health Association, American Society for Public Administration, American Statistical Association, and the Society of American Foresters, will engage in pilot projects of liaison with their professional counterparts all over the world. The seven societies were selected as those American professional groups which represent fields of endeavor that deal with greatest human needs. If the present effort proves successful, other professional societies will probably be asked to undertake such cooperative activity. We can all take pride in this very considerable tribute to our Society and the objectives for which it stands. You will hear more about the work as it progresses.



E. H. Graham

I think you will be interested in knowing that affairs of the Society are expanding to the extent that several new national committees have been required for 1956. An Objectives Committee, under chairmanship of Philip F. Allan, will give attention to ways and means of implementing the *philosophy and objectives* of the Society as they were recently restated by vote of the membership. Russell G. Hill heads a new Development Fund Committee, set up by action of the Council at Green Lake last fall, to study the possibility of raising funds for special uses within the Society by sustaining members, gifts or otherwise.

A Committee on International Relations will work with other professional soil conservation organizations throughout the world and will have a large hand in Society participation in the ICA project. It is under the chairmanship of O. M. McConkey of Canada. Walter Gumbel has agreed to chairman a Committee on Special Publications, already at work on a new Society booklet tentatively entitled *Make America Beautiful*. This committee will handle production of special publications of the Society, while H. F. Barrows' Business and Organization Relations Committee, in addition to its relations functions, will handle promotion of special publications, as it has done in the past with *Down the River* and *The Story of Land*. We shall probably also set up this year a Legal Counsel Committee.

Several committees are already hard at work on the annual national meeting to be held October 15-17 at Tulsa, Oklahoma. As I reported in my last column, William J. Endersbee has his Annual Meeting Program Committee busy, now reviewing a first draft of the program, and Myron Hurd, who heads the Local Arrangements Committee, has a corps of people throughout Oklahoma enthusiastically supporting the many arrangements that must be made for the national conclave. Leon J. McDonald has agreed to head up the Annual Meeting Publicity Committee.

A number of members who served well on committees last year have consented to give continuity to their committee assignments by carrying through for 1956. They are Ralph H. Musser for Fellows and Honorary Members; T. S. Buie for Archives; Herbert A. Hopper for Awards; Harold M. Rhodes for Membership; John Grant for Chapter Activities; Roy D. Hockensmith for Organization and Policy; Wallace Mitcheltree for the Technical Committees; and William H. Gracia for the Committee on Spanish Glossary, which plans to complete its work this year.

Among new appointees are R. G. Bullard to head the Election Committee; J. S. Russell to chairman the Finance Committee; and Adrian Fox for the Student Chapter Committee. Douglas E. Wade, Ben O. Osborn and Evan L. Flory have been added to the Editorial Board. B. D. Blakely remains as Society representative on the Joint Committee on Grassland Farming.

Full membership in these very important committees will be made known later, and will be published as customary in the annual meeting program. To all those who give time and effort to serve on the committees the Society is grateful. Our Committees, together with the all-important activities of our Chapters, which you can read something about in other parts of this and other issues of the JOURNAL, give real purpose and vitality to the Society. Bolstered by membership support, given by everyone who is a member of the Society, such activity makes the organization what it is today and what it can become.

The need to enlarge the committee work of the Society; the vigor being shown by many of the chapters in recent months; and the increasing membership—more persons joined the Society in January of this year than in any month in the past five years—all this expresses the expanding responsibilities of the Society and the greater opportunity that lies ahead *to advance the science and art of good land use.*

—EDWARD H. GRAHAM, *President.*

Society Banners Available For Chapters

Chapters desiring banners for use at their meetings, exhibits, etc., may now order them from the national office. They are sold to chapters at cost—$30—$35. Pictured above is the banner recently prepared for the North Carolina Chapter. The banner is four by six feet with a green background and orange letters. The Society emblem is prominently displayed on the banner.

The Pony Express Chapter in Kansas and the West Virginia Chapter have also purchased banners. The banners are made by Collegiate Mfg. Co., Ames, Iowa. Allow about one month for the banner to be made.

For chapters not desiring to purchase a banner, one may be borrowed from the parent Society.

The Financial Condition Of SCSA

Have you wondered how the Soil Conservation Society of America was financed? Do you know how much it costs to publish the JOURNAL OF SOIL AND WATER CONSERVATION? Have you questioned how your membership dues were spent?

Most members have given thought to the above questions and this article is an attempt to present the financial transactions for 1955 as well as the financial condition of your organization as of December 31, 1955.

During 1955 the Society had gross receipts of $67,941.32 as shown in Figure 1. This represents an increase of 60 per cent over 1954. Figure 1 also shows the receipts and expenditures for the last four years. This accounts for the entire period the Society has operated its national office with a paid staff. Prior to 1952 the gross income was less than $25,000 a year.

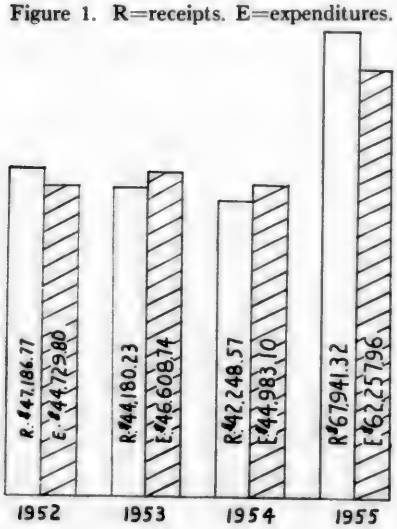
Figure 2 gives a graphic picture of the main reasons for increased income and expenditures. The $31,054.63 income from dues, an increase of $10,164.46 over 1954 was due in part to the change in constitution and by-laws making all dues $5, to the fact that sustaining memberships became available for those desiring to support the work in a more substantial manner, and to a difference in billing dates for collection of dues.

It is also shown in Figure 2 that booklet sales of $21,327.89 accounted for 31 per cent of the gross income of the Society in 1955.

Sale of advertising in the JOURNAL OF SOIL AND WATER CONSERVATION amounted to $10,473.18, a slight increase over 1954. Advertising income has nearly doubled since 1952 when the publication changed from a quarterly to a bi-monthly.

Figure 3 outlines the main sources of receipts and expenditures for 1955. JOURNAL advertising and sales listed in the chart includes sale of reprints and sale of extra copies. Miscellaneous income includes sale of emblems, annual meeting receipts, etc. The same chart shows in graphic form the expenditures.

Figure 1. R=receipts. E=expenditures.



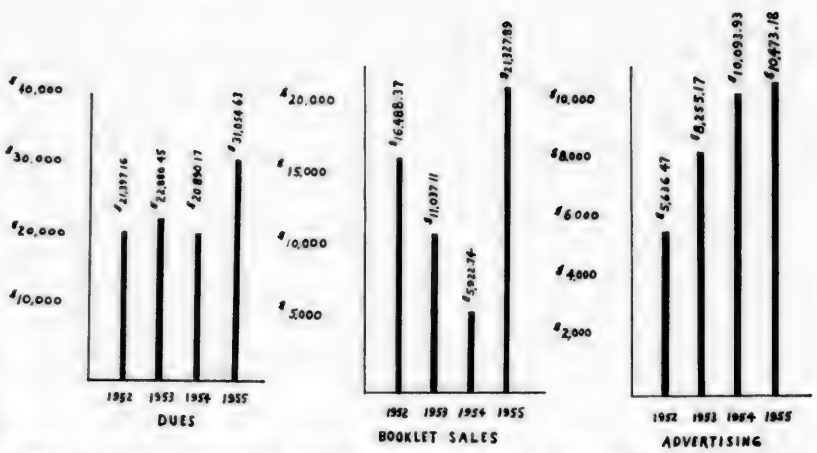


Figure 2. Income from dues, booklet sales, advertising, 1952-1955, inclusive.

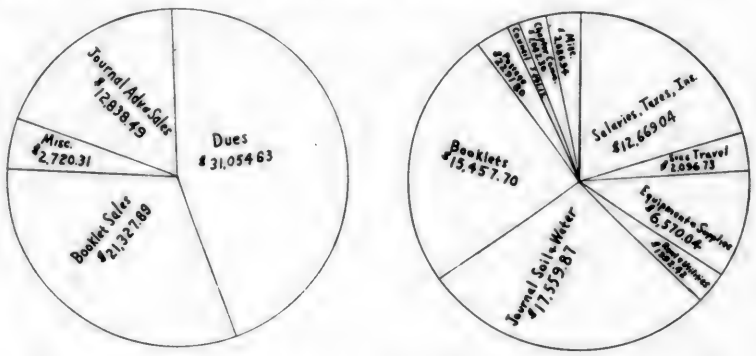

Journal Adv. Sales $ 12,838.49
Dues $ 31,054.63
Misc. $ 2,720.31
Booklet Sales $ 21,327.89
Salaries, Taxes, Ins. $ 12,669.04
Booklets $ 13,457.70
Journal Soil & Water $ 11,559.87
TOTAL OPERATING RECEIPTS FOR 1955 $ 67,941.32
TOTAL OPERATING EXPENDITURES FOR 1955 $ 62,257.96

Figure 3. Accounting of receipts and expenditures for 1955.

Peat, Marwick, Mitchell & Company, certified public accountants, were employed to audit the financial transactions of the Society and their report follows:

National Council,
Soil Conservation Society
of America, Incorporated,
Des Moines, Iowa
Dear Sirs:

Pursuant to instructions of the Treasurer, we have audited the books and records of the Treasurer's Account, Executive Secretary's Account and Reserve Account of the Soil Conservation Society of America, Incorporated, Des Moines, Iowa, for the year ended December 31, 1955, and herewith present the following statements:

Exhibit "A"—Statement of Combined Cash Receipts and Disbursements—Treasurer's and Executive Secretary's Accounts—Year Ended December 31, 1955.

Exhibit "A-1"—Statement of Operating Expenditures.

Exhibit "B"—Statement of Reserve Account Transactions.

Exhibit "C"—Schedule of United States Treasury Bonds—December 31, 1955.

Our examination was made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the attached statements present fairly the recorded cash receipts and disbursements of the Treasurer's Account, the Executive Secretary's Account and the Reserve Account of the Soil Conservation Society of America, Incorporated, for the year ended December 31, 1955.

Very truly yours,
Peat, Marwick, Mitchell & Co.
Certified Public Accountants

Exhibit "A"

Statement of Combined Cash Receipts and Disbursements, Treasurer's and Executive Secretary's Accounts, Year Ended December 31, 1955.

Operating Receipts		
Membership Dues		$31,054.63
Journal Advertising		10,473.18
Journal Sales and Reprints		2,365.31
"Story of Land"		17,050.26
"Down the River		3,962.95
Miscellaneous Booklets		314.68
Annual Meeting		678.11
Glossary Sales		100.00
Emblem Articles		659.77
Directory		675.00
Interest on Bonds		375.00
Miscellaneous		232.43
Total		$67,941.32
Operating Expenditures (Exhibit "A-1")		62,257.96
Net Operating Income		$ 5,683.36
Add		
Net Transfer from Reserve Account	$2,645.98	
Cash Balances— January 1, 1955		
Treasurer's Account	748.28	
Executive Secretary's Account	355.47	3,749.73
Cash Balances— December 31, 1955		
Treasurer's Account	$9,197.44	
Executive Secretary's Account	235.65	
		$ 9,433.09

Exhibit "A-1"

Statement of Operating Expenditures, Year Ended December 31, 1955.

Operating Expenditures:	
Salaries	$12,189.16
Pay Roll Taxes	165.36
Retirement Insurance	314.52
Secretarial travel	2,096.73
Equipment and Supplies	6,570.04
Rent and Utilities	1,859.98
Insurance	132.44
Journal Printing	13,480.70
Editor and Assistants	2,717.21
Reprints	961.96
Advertising Representation	400.00
"Story of Land"	13,017.10
"Down the River"	2,292.96
Miscellaneous Booklets	147.64
Postage	2,291.80
Council Expenses	491.12
Commissions to Chapters	1,042.30
Freight and Express	339.87
Emblem Expense	498.19
Annual Meeting	687.91
Auditing	100.00
Membership Refunds	45.00
Miscellaneous	415.97
Total	$62,257.96

Note: $5,430.92 of the above expenditures were paid through the Executive Secretary's Account.

Exhibit "B"

Statement of Reserve Account Transactions, Year Ended December 31, 1955.

	Total	*Savings*	*Bonds*
Bal. 1-1-55	$18,399.24	$3,399.24	$15,000.00
Add			
Int.	32.74	32.74	—
Trans. from Treas.	785.00	785.00	—
	$19,216.98	$4,216.98	$15,000.00
Deduct			
Transfer to Treas. Acct.	3,430.98	3,430.98	—
Bal. 12-31-55	$15,786.00	$ 786.00	$15,000.00

Exhibit "C"

Schedule of United States Treasury Bonds, December 31, 1955.

In Name of	*Issuing Date*	*Series "G" Serial No.*	*Cost*
Soil Conservation Society of America	5-47	D3-413413G	$ 500.00
	5-47	M7-609157G	1,000.00
	5-47	M7-609158G	1,000.00
	2-48	M7-609159G	1,000.00
	2-48	M7-609160G	1,000.00
	4-49	M7-609161G	1,000.00
	4-49	M7-609162G	1,000.00
	8-50	M7-455615G	1,000.00
	8-50	M7-455616G	1,000.00
	1-51	M7-736364G	1,000.00
	1-51	M7-736365G	1,000.00
	2-51	M7-738012G	1,000.00
	2-51	M7-738013G	1,000.00
	7-51	M7-788217G	1,000.00
	7-51	D-3486001G	500.00
	2-52	M8-239007G	1,000.00
Total			$15,000.00

The audit conducted by Peat, Marwick, Mitchell & Co. included only the cash transactions. The following financial or net worth statement, including inventory, was prepared by the executive secretary:

Net Worth Statement

Assets:	
Cash (Treasurer's account)	$ 9,197.44
Cash (Secretary's account)	235.65
Savings Account	786.00
Treasury Bonds	15,000.00
Supplies on hand	5,243.92[1]
Equipment	3,363.80[2]
Accounts receivable	2,355.07
Deposit with United Airlines	425.00
Total	$36,606.88
Liabilities:	
Accounts payable	$ 137.42
Commissions due chapters	$ 1,179.23[3]
Total	$ 1,316.65
Net Worth 12-31-55	$35,290.23
Net Worth 12-31-54	24,881.90
Increase in Net Worth	$10,408.33

1 Supplies included 100,100 copies of "Story of Land" and 38,300 copies "Down the River" figured at cost value. The sale value would be higher.

UNESCO Coupons Accepted

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has available Unesco Coupons to help institutions and individual people in Unesco member countries to buy publications of an educational and scientific nature. The coupons may also be used for scientific material, films, etc.

The Soil Conservation Society of America accepts such coupons. Coupons are issued in values of $1,000, $100, $30, $10, $3, $1, 25c and "blank" which may be made out for amounts from 1 to 99 United States cents.

In each participating country coupons will be sold for national currency at the official dollar rate on day of sale. For additional information contact your proper official or write the Soil Conservation Society of America.

For members in countries not participating in UNESCO and having difficulty in securing transfer of funds, contact a representative of United States International Cooperative Association or the U. S. Embassy. They may be able to assist.

Journal Damaged? Write Headquarters!

Faced with a 5% increase in printing cost, we are now mailing JOURNALS, except to foreign members, without envelopes. If your copy arrives in poor condition please write for replacement.

We have checked with other organizations and find they have taken similar measures. It would cost $800 to mail 1956 JOURNALS in envelopes—we hope you concur with the decision.

—Executive Secretary

2 Equipment represents an increase in value from $2,347.27 last year to $3,363.80 despite an annual 10 per cent depreciation. Considerable necessary equipment was purchased in 1955.

3 Commissions are paid every six months to chapters assisting in the sale of Society publications.

The audit shows in detail expenditures and income. The bonds owned by the Society were accumulated prior to the opening of the national office. The savings account accumulated from interest on the bonds plus funds transferred from the former secretary and not deposited in the treasurer's account. Last year it was necessary to invest the savings account in inventory of the booklet "Story of Land." Later in the year $375 interest was deposited in the savings account plus an additional amount secured from sustaining memberships. The savings account is under the supervision of the treasurer and national council.

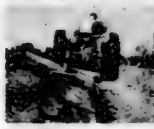
As related in the January issue of the JOURNAL, the Society has need for additional funds to carry on an expanded program in 1956. During 1956 it is anticipated that the Society will employ an editor for the publication, rent larger office space. The Society is also faced with a six per cent increase in publication cost. The program for 1956 can easily be accomplished if the membership of the Society can be increased by the 2,000 members established as a goal by the membership committee under the direction of Harold M. Rhodes.

NEW!

SHAWNEE SCRAPER

At a low price that makes it possible for you to dig your own trench silos, ditches, canals — build terraces, too.

The Shawnee Scraper is designed for and is approved for mounting on International Harvester "300" Utility Tractor. It operates off tractor hydraulic system. ⅝ yard capacity, cutting edge 66 inches wide. Cutting edge extends beyond wheels and sides of scraper permitting deep digging.



Shawnee Model 200 REAR BLADE

Exclusive all-position from driver's seat! Blade may be tilted or extended right or left manually. Ideal for 'V' ditches. Instantly reversible.

Ad 540

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TOPEKA, KANSAS

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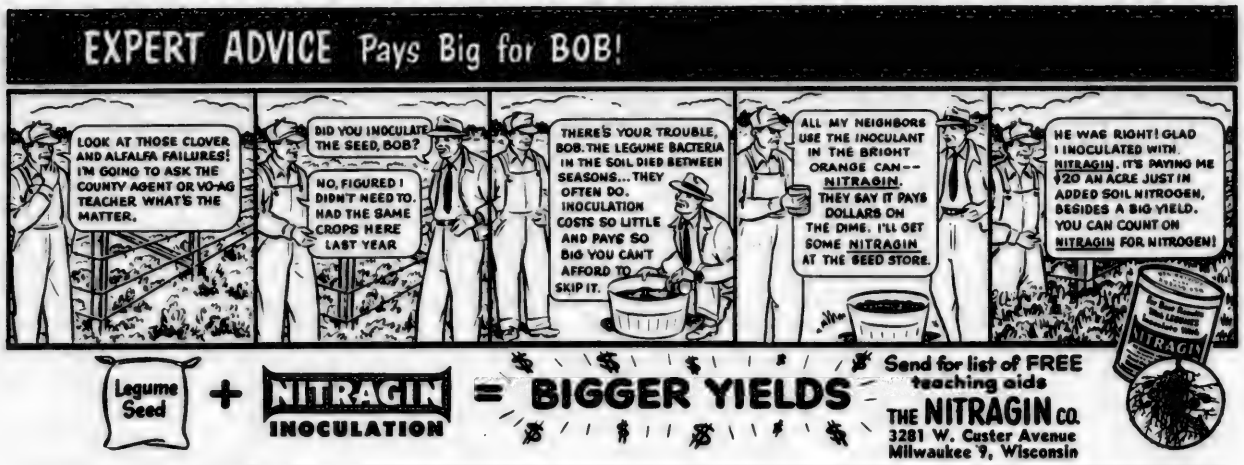
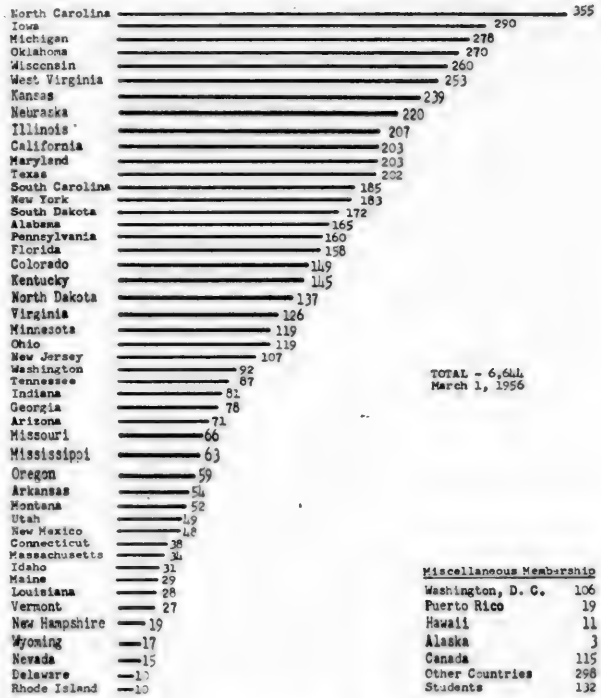

EXPERT ADVICE Pays Big for BOB!
LOOK AT THOSE CLOVER AND ALFALFA FAILURES! I'M GOING TO ASK THE COUNTY AGENT OR VO-AG TEACHER WHAT'S THE MATTER.
DID YOU INOCULATE THE SEED, BOB?
NO, FIGURED I DIDN'T NEED TO. HAD THE SAME CROPS HERE LAST YEAR
THERE'S YOUR TROUBLE, BOB. THE LEGUME BACTERIA IN THE SOIL DIED BETWEEN SEASONS... THEY OFTEN DO. INOCULATION COSTS SO LITTLE AND PAYS SO BIG YOU CAN'T AFFORD TO SKIP IT.
ALL MY NEIGHBORS USE THE INOCULANT IN THE BRIGHT ORANGE CAN-- NITRAGIN. THEY SAY IT PAYS DOLLARS ON THE DIME. I'LL GET SOME NITRAGIN AT THE SEED STORE.
HE WAS RIGHT! GLAD I INOCULATED WITH NITRAGIN. IT'S PAYING ME $20 AN ACRE JUST IN ADDED SOIL NITROGEN, BESIDES A BIG YIELD. YOU CAN COUNT ON NITRAGIN FOR NITROGEN!
Legume Seed + NITRAGIN INOCULATION = BIGGER YIELDS
Send for list of FREE teaching aids
THE NITRAGIN CO.
3281 W. Custer Avenue
Milwaukee 9, Wisconsin

Membership Quota SCSA—1956

State or Area	Reinstated Jan. and Feb.	New Members Jan. and Feb.	Total to February 29	Quota for 1956	Remaining Quota
Alabama	0	2	2	50	48
Arizona	1	5	6	25	19
Arkansas	0	2	2	25	23
California	0	1	1	70	69
Colorado	2	1	3	25	22
Connecticut	1	0	1	10	9
Delaware	0	0	0	10	10
Florida	0	0	0	50	50
Georgia	1	2	3	25	22
Idaho	0	2	2	20	18
Indiana	1	2	3	50	47
Illinois	2	10	12	60	48
Iowa	3	7	10	50	40
Kansas	4	31	35	50	15
Kentucky	6	3	9	60	51
Louisiana	0	4	4	25	21
Maine	0	1	1	10	9
Maryland	3	9	12	25	13
Massachusetts	0	1	1	20	19
Michigan	9	14	23	70	47
Minnesota	1	9	10	40	30
Mississippi	2	4	6	50	44
Missouri	1	2	3	60	57
Montana	0	2	2	25	23
Nebraska	4	15	19	50	31
Nevada	0	3	3	10	7
New Hampshire	0	0	0	10	10
New Jersey	2	3	5	50	45
New Mexico	1	3	4	25	21
New York	3	2	5	25	20
North Carolina	2	5	7	70	63
North Dakota	2	12	14	50	36
Ohio	0	2	2	70	68
Oklahoma	15	116	131	100	+ 31
Oregon	1	1	2	20	18
Pennsylvania	2	1	3	30	27
Rhode Island	0	0	0	10	10
South Carolina	1	11	12	50	38
South Dakota	14	44	58	50	+ 8
Tennessee	12	16	28	50	22
Texas	1	9	10	50	40
Utah	1	1	2	20	18
Vermont	0	1	1	10	9
Virginia	1	5	6	25	19
Washington	1	2	3	20	17
West Virginia	1	1	2	70	68
Wisconsin	2	9	11	70	59
Wyoming	0	0	0	20	20
District of Columbia	1	1	2	30	28
Puerto Rico	0	0	0	10	10
Canada	1	1	2	50	48
Foreign	4	29	33	50	17
(Misc.: Alaska, Hawaii, Students)	2	35	37		+ 37
Totals	111	442	553	2,000	1,447

The 1956 membership committee established quotas for each chapter and state. Oklahoma and South Dakota exceeded their goal in the first two months.

How Does Your State Rank?



TOTAL - 6,644
March 1, 1956

Miscellaneous Membership	
Washington, D. C.	106
Puerto Rico	19
Hawaii	11
Alaska	3
Canada	115
Other Countries	298
Students	132

The membership of the Society on March 1, 1956 was 6,644 as shown on the above chart. The chart shows all who were members in 1955 as well as new memberships received until March 1.

Recent gains in membership have been made in Oklahoma to increase its standing from ninteenth on December 1, 1955 to fourth on March 1, 1956. Secretary Pritchard recently commented, "It is entirely possible that Oklahoma ranks first among all states when only 1956 dues are counted."

Second notices for 1956 dues have just been mailed to 2,600 individuals. Those who have not paid by May 1 will be dropped from the rolls prior to mailing the July Journal.

NOW IS THE TIME TO MAKE CERTAIN YOUR DUES ARE PAID.

Grant Elected West Virginia Chairman

John Grant of Fairmont, manager of the Upper Monongahela Valley Association, was elected president of the West Virginia Chapter, *Soil Conservation Society of America*, at the recent annual meeting at Jackson's Mill. He succeeds George Sharpe of Morgantown. Ninety persons attended the meeting.

Other officers and area chairmen elected were: Frank W. Glover of Morgantown, reelected vice-president and renamed membership chairman with a goal of 325 members; E. V. Wickline of Lewisburg, secretary-treasurer; Joseph Ruffner of Romney, Area 1; Warren Friend of Kingwood, Area 2; Benjamin F. Blackburn of Moundsville, Area 3; Sam C. Forinash of Jane Lew, Area 4; J. B. Clark of Charleston, Area 5; Robin L. Harvey of Union, Area 6; John Wright of Winfield, Area 7.

In the main banquet speech, Dr. Firman E. Bear, Editor of *Soil Science*, cited the tremendous problems of feeding a steady increasing population in this new age of science. He pointed to the increasing removal of good agricultural land from production through the extension of turnpikes, industries, cities, and other construction into these areas.

Possibilities that molybdenum deficiencies may be present besides those that affected cauliflower growth in the Canaan Valley were pointed to by Charles Kline of New York City of the Climax Molybdenum Company. Kline pointed out correcting deficiencies of certain trace elements frequently has meant that the addition of considerable quantities of lime in acid soils is not necessary.

L. L. Lough of Morgantown, State Conservationist, and Walter C. Gumbel of Fairmont, Conservationist for the Monongahela Power Company, were awarded placques for long and continued service to the chapter.

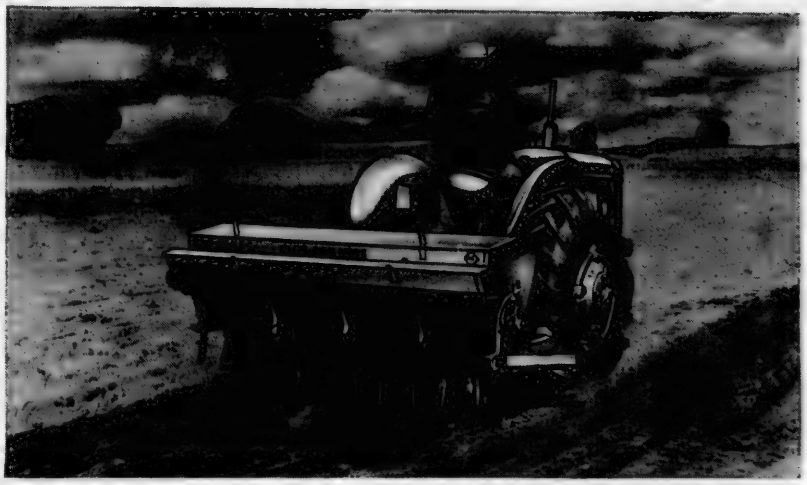
Other committee appointments for the coming year were announced as follows: Joseph Kuykendall of Morgantown, Chapter Activities; Glendon P. Burton of Parkersburg, Promotion of the Booklet "Story of the Land" with a goal of 20,000 copies to be sold; John Nelson of Morgantown, "Chapter Chats" editor; Jack Myers of Princeton, Program; Sharpe, Nomination and Awards; Ross H. Mellinger of Elizabeth, Archives; and others. The Executive Council will meet in Sutton, December 12.

Other speakers were Tyler Quakenbush of Washington, D. C., "Supplemental Irrigation in the East"; Jack Barrick of Salem, "Sale of 55,600 copies of 'Down the River'"; Alfred Millender of Morgantown, "Progress of Small Watershed Programs in West Virginia"; George Toben of Morgantown pointed to the smaller us of lime and fertilizer in West Virginia; Sidney Weitzman of Elkins, "Woodland and Watershed Management under West Virginia Conditions"; K. B. Brundage of Morgantown, "Farm and Home Management Program."

H. Trell Reger of Morgantown appealed for more help from conservationists in getting loans through the Farmers' Home Administration, while John M. Lowe of Charleston summarized the many conservation projects of vocational agriculture students.

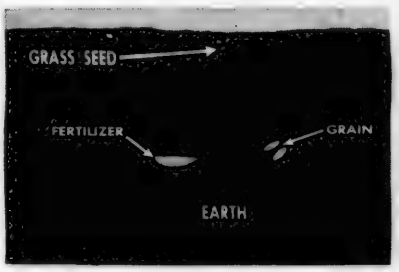
NOW!

NEW PRECISION FOR CONSERVATION FARMING



Here's a tractor-mounted, hydraulically-lifted and lowered tool that's made to order for conservation — the ALL-CROP drill, built by Allis-Chalmers . . . and designed for use with Models CA, WD and WD-45 Tractors.

Separate band placement of seed and fertilizer makes this fully-mounted drill ideal for today's changing farm pattern. Grain, grass or legume seeds and fertilizer can be drilled all at the same time, or separately, as desired. Grass and legume seed can be either broadcast or band-seeded. Seed and fertilizer are deposited uniformly at the proper depth.



With band placement of fertilizer, there's no "burning" of tender roots and plants. Yet young seedlings can take full advantage of the extra plant food — thanks to Allis-Chalmers twin-boot design.

Fertilizer is deposited through the front boot and placed in a separate band. Grain seeds are fed through the rear boot about one inch to the side of the fertilizer. Grass seed is fed straight down behind the double-disc openers and gently and uniformly stirred into the topsoil by the covering chains.

The non-clogging MICRO-FEED meters grain kernels individually, instead of in bunches. Each plant has a chance for a full yield. Force-Flo agitators in the fertilizer hopper break up lumpy fertilizer for even distribution.

These and many other features put the ALL-CROP drill in a class by itself as an aid to conservation farming. For full information, write for illustrated literature.

ALLIS-CHALMERS, FARM EQUIPMENT DIVISION
MILWAUKEE 1, WISCONSIN

ALL-CROP is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Now save ¾ of fertilizer cost
with depth placement while seeding!

Pays For Itself In 4 Days' Use!

Pasture or seed bed — Servis Pasture Renovator (new model Double Deck Soil Builder) operates on both, is a year 'round tool.

Surprisingly light draft — tractor mounted, has less draft than pull-type. Caster-mounted coulters cut turf, are followed by openers that place fertilizer up to 6" deep. Seed openers are offset and followed by press wheels. Seeds may be placed 0 inches to 2 inches deep.

Tests prove savings. Well-known independent agronomists have sent us reports of carefully controlled tests showing that under many typical farm conditions, 100 lbs. of fertilizer placed below the roots gets results equal to or better than 300 to 400 lbs. on the surface.

Prominent farmer reports. Clinton Harber, nationally honored farmer and Texas Farmer of the Year, has reported equal fertilizer savings through depth placement on his West Point, Texas, farm.

Pays out in 4 days. Figuring fertilizer at $3.50 per cwt., with 100 lbs. used where 400 lbs. was formerly needed, this tool pays for itself in cost of fertilizer alone when used once on 55 acres of pasture.

Many purpose tool. Spacing may be changed, coulters and press wheels removed for side dressing, or used as drill or chisel. Plants legumes while fertilizing row crops in mulch farming.

Light or heavy tractors. Fits 3-pt. lift or tool bar tractors, 2 or 3-plow size. Remarkably low priced.

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Please send me information on items checked.
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☐ Pasture Renovator
☐ Whirlwind Terracer
☐ Gyro 84 Brush Cutter (pull-type)
☐ Gyro 66 or 57 Shredders (lift or pull)
☐ 3-Way Ditcher Blade (std. or h.d.)
☐ No. 7 Angledozer (row crop tractors)
☐ Dump Type Rake
☐ Hudson Automatic Row Marker
☐ Rotary (row) Weeder
☐ "Sur-Stan" Press Wheels

Make Pay Dirt Pay More . . . Join Your Soil Conservation District!

Schools Like "Down the River"

A recent letter from Leslie Fox Keyser, Supervisor of Elementary Schools, Warren and Rappahannock Public School System, Front Royal, Virginia, stated in part:

"Your booklet 'Down the River', has been made available for use by the students in our schools through the Lord Fairfax Soil Conservation District.

"I wish to commend your organization for the preparation of such excellent material. The features which make especially for the usefulness of this publication are the simple vocabulary, concreteness of ideas presented, the excellence of pictures used, the personal appeal, and the good taste in the make-up of the bulletin."

Are Your Dues Paid For 1956?

Keystone Chapter Meets

The 9th Annual Meeting of the Keystone Chapter was held at Penn State University on August 26 and 27, 1955 About 75 members, wives, guests and friends attended.

Howard Busch, program chairman, introduced Dean Lyman E. Jackson, College of Agriculture. Dean Jackson welcomed the group to Penn State University for the annual meeting.

Howard Busch then introduced Mrs. Marguerite L. Duvall, Family Life Extension Specialist, whose topic was "Search for Happiness."

Dr. Fred C. Miller, of Altoona, spoke on "Conservation of the Body."

The ladies present were conducted on a tour through the flower gardens by Mrs. Bryner, while the men went into the business meeting.

The evening session was opened with a short talk by Walter Gumbel on the parent society. Then followed an interesting set of Slides by Dr. George Johnson, of the Extension Service, on "Penn State's First Hundred Years."

Highlight of the Saturday morning meeting was a panel, consisting of Walter Gumbel as moderator, along with Dr. Graham Netting and Dr. M. E. John. The discussion was on the subject of the principles that motivate people.

Northern New England Chapter

The Northern New England Chapter held an area meeting in Maine on June 24, 1955. The group met at Christmas Tree Inn on Highland Lake for lunch. Following lunch the group made a trip through the wood lot of Bobert Dinneen, Maine State Chief Service Forester. Mr. Dinneen showed how small farmers and woodlot owners can make their woodlots pay dividends.

At the banquet Stephen Powell, Biologist of the Maine Department of Inland Fisheries and Game, gave an interesting commentary on the wildlife of Swan Island.

Ten year service awards to several members of the Soil Conservation Service were presented during the evening by William B. Oliver, State Conservationist for Maine.

Next morning the group toured the farm of James Chadbourne of North Bridgeton where he demonstrated sawdust mulching on a new field of strawberries. Sixty members attended.

The Vermont Area meeting of the chapter was held on June 17 and 18 at the Mount Mansfield State Forest. A trip was taken to the top of Mt. Mansfield via a chair lift. The lift is 1¼ miles long and rises 2,400 feet. Dr. Fred H. Taylor, Professor of Botany, University of Vermont, discussed alpine vegetation during the trip.

Later the group assembled for a lobster dinner and to hear Rheinhold Thime, Acting Commissioner, Vermont State Water Board, talk and show pictures on "Why Dams Fail." Next morning another field trip was taken to visit forestry work in the area of Stowe, Vermont.

Southern New England Chapter Meeting

About 75 members and guests of the Southern New England Chapter, Soil Conservation Society of America, met at the Tobacco Laboratory of The Connecticut Agriculture Experiment Station on August 8.

Dr. H. C. DeRoo, of the Station's Soils Department, showed how soil compaction affects the root distribution of tobacco plants. He has devised a needle-board to permit moving an undisturbed slice of soil and roots to the laboratory for examination and photography of the root system. These comparative studies show both the extent of the root system and the depth of root penetration in soils with the usual hardpan and in soils where the compact hardpan layer has been broken by a new subsoil plow operating in the open furrow, directly behind the rear wheel of the tractor. A built-in attachment makes it possible to place fertilizer at the level of the subsoil blade.

The measurement and effect of soil compaction by tractors in tobacco fields is one of the studies underway at the Station. Other soils studies have to do with fertilization at different soil levels, and irrigation.

Dr. Gordon Taylor, Assistant to the Director, explained the kinds of research projects underway at Windsor on breeding, production at lower cost, and curing. He pointed out, with specific reference to development of a mosiac-resistant strain, that about 10 years of plant breeding is commonly required before a promising introduction is ready for limited field testing on farms.

Director James G. Horsfall welcomed the guests to the Tobacco Laboratory. Lawrence T. Small, of the Soil Conservation Service in Hartford County, was chairman of the program committee, with Dr. C. L. W. Swanson and Dr. Taylor as other members. Dr. Swanson is head of Soils Department at The Connecticut Agricultural Experiment Station. W. Theodore Hebel, Middleton, is chairman of the Southern New England chapter of the society.

Russell Anderson, Hartford County Agent, and C. S. Britt, Beltsville, Maryland, soil conservationist, were speakers at the afternoon session, which was followed by a tour of a helicopter plant and a visit to a tobacco plantation.

From The Mail Box

". . . Thank you very much for my 1956 Honorary Membership Card in the Soil Conservation Society of America. I appreciate this membership in the Society very much and watch your growing program with great interest."—Walter R. Humphrey, Editor, The Fort Worth Press.

". . . Your presentation of our article 'Downstream Effects of Upstream Floodwater-Retarding Structures' was entirely satisfactory. We appreciate your publication of this article in the interest of the 'flood control' controversy."—Richard W. Wilke, Hydraulic Engineer, U. S. Forest Service, Missoula, Montana.

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opens new concepts in
VERTICAL FARMING
new ways to harvest more profit per acre

HIGH-PROFIT Vertical Farming with the Harvestore is an exciting new, proven principle of "live" storage. It makes more intense use of land, crops, fertilizer, materials handling . . . multiplies the profit from the farmer's present acreage because it eliminates the usual losses from weather, field storage and handling, grazing and spoilage.

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Harvestore high-profit "live" storage reduces the labor of feeding. It cuts the cost of feed itself by "processing" hay, silage, whole and ground corn in a first-in, first-out cycle. This exclusive method retains high nutrient value and ideal moisture levels.

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The facts are told in a new booklet—The Harvestore Farm Profit Plan. It includes a detailed questionnaire, that when completed and analyzed by our Farm Consultants, tells how the Harvestore fits specific farming operations.

A free copy of the booklet and a sample questionnaire are yours for the asking. Just mail the coupon below.

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- **EXCLUSIVE** sealed construction locks out oxygen, moisture.
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- **EXCLUSIVE** mechanical bottom unloader combines with A. O. Smith mechanical feeder to give you exclusive top to bottom "live" storage-cured-feed even when filling.

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Please send me without obligation the booklet "The Harvestore Farm Profit Plan" and the sample high-profit plan questionnaire.

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Manhattan Chapter

Forty-eight attended the Manhattan Chapter meeting in Manhattan on December 2, 1955. During the election of officers, Earl Nichols of Clay Center was elected chairman; O. W. Bidwell, vice chairman; B. K. Geraghty of Manhattan, secretary, and Raymond Neher, Manhattan, council member.

Bernard Roepke of Barnes, Kansas, a member of the Riley County Board of Soil Conservation District Supervisors, told of his experiences as a guest of the Goodyear Tire and Rubber Company at their model farm at Litchfield Park, Arizona. Fred Germann, Riley County representative, was present and said a few words to the meeting.

Pony Express Chapter Meets

The Pony Express Chapter met at Lawrence, Kansas, March 5, 1956 with Col. Adams of the Corps of Engineers as speaker.

New officers of the Pony Express Chapter include: Kyle Moran, Topeka, chairman; Dan Burris, Holton, vice chairman; George Jorgesen, Jr., Olathe, secretary; Norman Kruse, Leavenworth, treasurer; M. C. Cummings, Effingham, council; Nathan Babcock, Jiawatha, council.

Husband and Wife Members

Mr. and Mrs. John J. Bailey, Jr. of Route 3, Tarbaro, North Carolina, are both active members of the Society. John is county office manager for ASC, having held that position since 1947. Christine (Mrs. Bailey) is ACP clerk for the ASC county committee and has served in that capacity since 1948.

Mr. and Mrs. David O. Davis of 1240 South Xavier Street, Denver, Colorado, are active members of the Society. Mrs. Davis has a major in Geology and has actively promoted conservation in many capacities. Mr. Davis has served as Information Specialist for the Soil Conservation Service.

Are there other husband and wife combinations in the Society?

Endersbee and Hurd Committee Chairmen

President Graham has anounced several committee appointments for 1956. William J. Endersbee, a Fellow in the Society and past chairman of the Washington, D. C. Chapter will serve as chairman of the 1956 annual meeting program committee.

The eleventh annual meeting will be held at the Mayo Hotel, Tulsa, Oklahoma, October 15-17, 1956. Myron A. Hurd of Claremeore, Oklahoma, past chairman of the Northeast Oklahoma Chapter, has been appointed as chairman of local arrangements. He will have as assistants several others to be named by him.

Members with papers or suggestions for the annual meeting program should contact Wm. J. Endersbee, Department of Interior, Washington, D. C.

Other members of the annual meeting program committee include:

M. D. Atkins, Box 798, Manhattan, Kansas.

E. D. Bolton, P. O. Box 910, Nacogdoches, Texas.

Harry M. Chambers, 2513 N. W. 25th St., Oklahoma City, Oklahoma.

E. A. Colman, P. O. Box 245, Berkeley, California.

Malcolm P. Crooks, R. R. 2, Doylestown, Pennslyvania.

F. L. Duley, 2212 Washington St., Lincoln, Nebraska.

H. C. Fletcher, P. O. Box 835, Boise, Idaho.

Russell G. Hill, 717 Newton St., Lansing 12, Michigan.

Frank W. Schaller, 225 Agron. Bldg., Ames, Iowa.

J. K. Vessey, 810 Evans Ave., Missoula, Montana.

Edward G. Pleva, Dept. of Geog., Univ. of W. Ont., London, Ont.

Clair Guess, Executive Secretary of South Carolina State Soil Conservation Committee, says, "Pin your Society membership card on the wall behind your desk—right now! This is a good safe place for it and will give you the opportunity to talk with others about membership in the Society."

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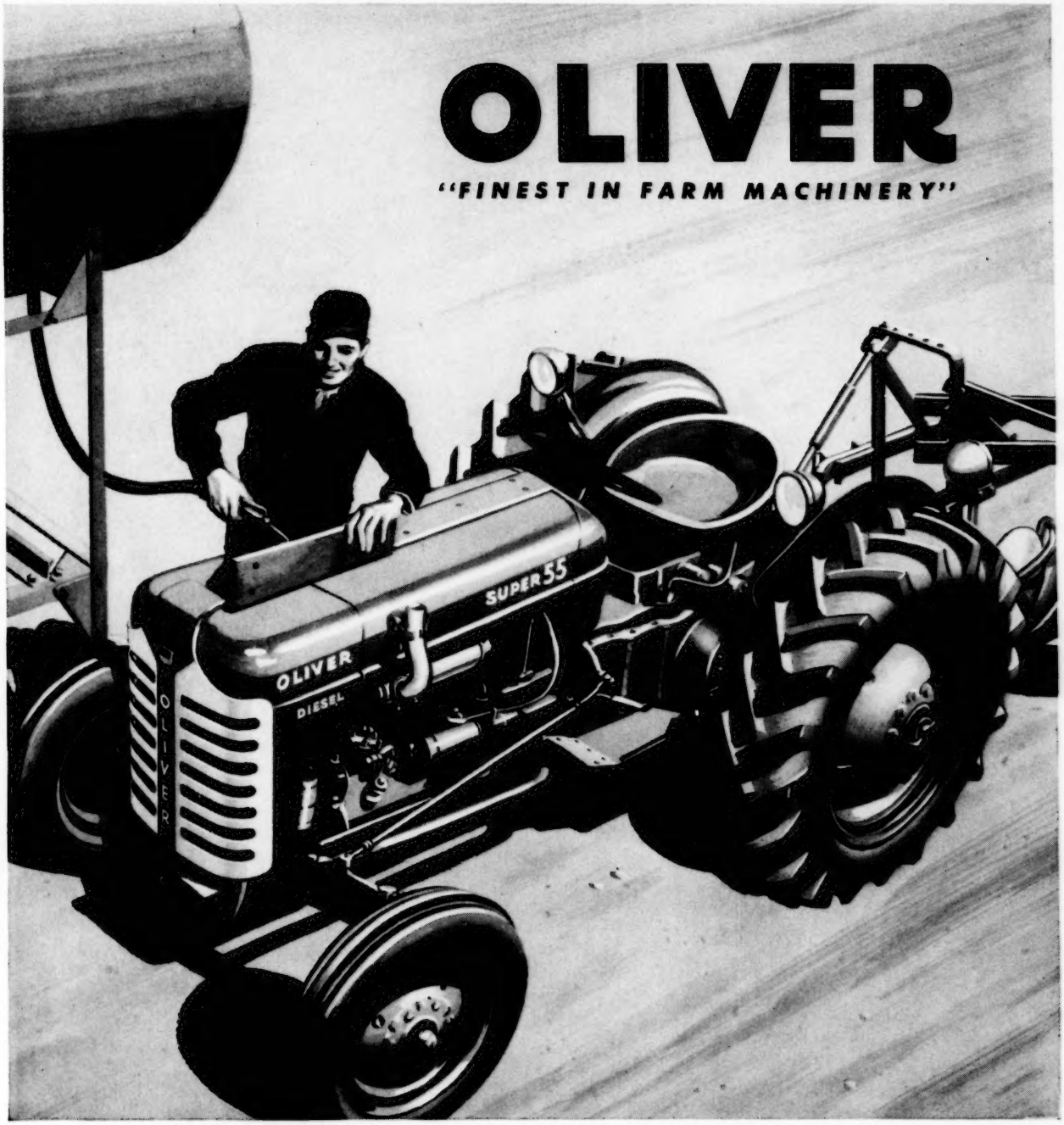

Only Oliver offers diesel in this Super 55 2-3 plow utility tractor as well as its five other wheel tractor sizes.

$1 for fuel, $2 for the farmer!

That's just how it works out when the farmer goes to an Oliver diesel. Where he used to put, say, three dollars' worth of fuel in the tank, now it takes but one—he keeps the other $2.00.

How can this be? Well, in the first place, he burns only six gallons of diesel fuel to ten of gasoline. Then, of course, his diesel fuel costs much less. These two factors—fewer gallons, lower price—knock as much as two-thirds off his fuel bills.

Such savings are his no matter what size Oliver he buys. Because Oliver, alone among farm equipment makers, offers him a dollar-saving diesel in each of its six wheel tractor sizes. And each of them—from the handy Super 55 up through the mighty Super 99 GM—offers features that no other tractor can match.

Remember, too, these Olivers are real diesels. A touch of the starter button and he is ready for work. No extra starting engine or special starting fuel needed. Yes, there's a difference in diesels, a difference he sees—when he sees his Oliver dealer.

The Oliver Corporation
400 West Madison St.
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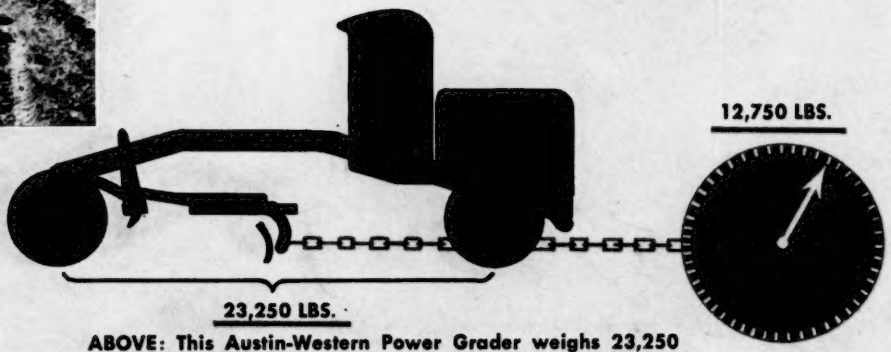
OLIVER

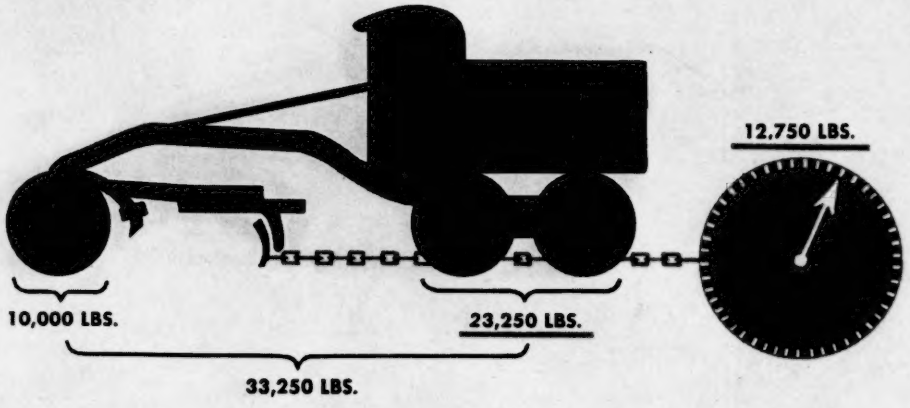
Not "How Big?" But "How Good?"

The ability of any motor grader to do hard cutting, and move big blade loads of material in the lower gears, where heavy work is done, depends entirely upon the amount of weight carried on *driving wheels.* Total weight has nothing to do with it.



ABOVE: This Austin-Western Power Grader weighs 23,250 lbs.—all carried on driving wheels. Working in average dirt, it has a blade pull of 12,750 lbs.

BELOW: To obtain the same blade pull, an ordinary motor grader would have to carry 23,250 lbs. on its *rear drivers;* PLUS about 10,000 lbs. on its *dead front end,* for a total of 33,250 lbs.



Most for Your Money

From every standpoint . . . first cost, operating cost and upkeep . . . the A-W Power Grader gives you more for your money . . . moves 30 percent more material than an ordinary grader of equal weight and horsepower; and as much material as heavier, more expensive graders . . . as explained in the diagrams at the right.

SIZE IS NOT THE MEASURE OF MOTOR GRADER PERFORMANCE

There's more to the story. All-Wheel Steer . . . another exclusive Austin-Western feature . . . makes the machine twice as maneuverable as graders with front steer only; while the Controlled Traction made possible by the teamwork of All-Wheel Drive and All-Wheel Steer moves more material . . . moves it farther . . . moves it faster. Your nearby Austin-Western distributor will be glad to tell you the whole story of "The Power Graders That Have Everything."

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